THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XXII. No. 540.] LONDON, JUNE 3, 1873. [25TH YEAR.] Price 1s.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—10,000 cubic feet of gas per ton of coal; 28-candle gas; 13¼ cwt. coke per ton of coal.
RAMSAY'S PATENT CONDENSED COKE.
DO. GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.

GAS-RETORTS, introduced 1828. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.

Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne; and London Wharves—Falcon Wharf, No. 80, Bankside; and Honduras Wharf, Cubitt Town. Large stocks kept.

Address G. H. RAMSAY, NEWCASTLE-ON-TYNE.

GEORGE GLOVER & CO.,

Patentees of the Standard Gasometers for the Government, and of the

IMPROVED DRY GAS-METERS.

These Meters are warranted to measure correctly and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured.

To meet the increasing demand, G. GLOVER AND CO. have just entered on possession of extensive premises adjoining their present Works in Ranelagh Road, and they are now prepared to execute promptly, orders to any extent. They keep in stock all sizes of Meters up to 200 lights. In cases of haste, on the receipt of a telegram early on one day, their Meters can be delivered next day in any part of England, and in the large towns in Scotland.

Particulars and lists of prices forwarded on application to—

RANELAGH ROAD, PIMLICO, LONDON, S.W.;
236, GEORGE STREET, GLASGOW;
OR
15, MARKET STREET, MANCHESTER.

COWEN'S PATENT FIRE-CLAY RETORTS.

JOSEPH COWEN and CO.,

BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE,

Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they have also been awarded in the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."

J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.

COWEN'S GARESFIELD COALS.
Coal Office,
QUAY SIDE, NEWCASTLE-ON-TYNE.

JOHN RUSSELL AND CO.,

THE OLD TUBE-WORKS, WEDNESBURY
AND
THE ALMA WORKS, WALSALL.
Established at the commencement of Gas Lighting.

WAREHOUSES:
69, UPPER THAMES STREET;
COMMERCIAL STREET, SPITALFIELDS;
5, CHARLES STREET, SOHO; and
16, SOHO SQUARE,
} LONDON
35, 36, 37, & 39, GRANBY ROW, MANCHESTER.

J. R. and Co. are the original manufacturers of Wrought-Iron Gas Tubes and Fittings, and Inventors of the LAP-WELDED TUBES for Locomotive and Marine Boilers.

J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water; Gun-Metal Cocks, Stocks, and Dies; Galvanized Tubes and High-Pressure Tubes, &c.

Lists may be obtained on application to
69, UPPER THAMES STREET, LONDON.

JOHN BENT & SON,

WET AND DRY GAS-METER
AND
STREET-LAMP
MANUFACTURERS,
BELL BARN ROAD, BIRMINGHAM.
ESTABLISHED 1830.

All materials found for the alteration of Public Lamps for lighting with the Rod. Regulators with Lava Burners.

BLAYDON BURN AND LOW BENWELL FIRE-CLAY RETORT AND FIRE-BRICK WORKS,
NEAR NEWCASTLE-ON-TYNE.

WILLIAM COCHRAN CARR begs most respectfully to thank the Metropolitan, Provincial, and Continental Gas Companies for their patronage for several years past, and to intimate that he has rebuilt and enlarged his extensive premises for the manufacture of CLAY RETORTS; and that he is now prepared to execute the largest orders with punctuality and despatch. Orders for FIRE-CLAY RETORTS, of all shapes and sizes, FIRE-BRICKS, and all other articles in Fire-Clay, executed on the shortest notice, and on the most reasonable terms.

London Agents: JAMES LAWRIE & CO.,
63, OLD BROAD STREET, CITY, LONDON.

SCOTTISH CANNEL COAL.

J. & W. ROMANS, Consulting Gas Engineers and Coal Factors, of Edinburgh and London, CONTRACT for supplying any quantity of COAL and CANNEL.

They are also Contractors for leasing Gas-Works, for supplying, erecting, or repairing gas apparatus and fire-clay goods.

Messrs. ROMANS, being lessees of several Gas-Works, have their Cannels tested in the ordinary working process, thus securing for their customers a guarantee beyond mere laboratory experiments.

Analysis, prices, and other information will be forwarded on application to their Offices, 8, Forth Street, EDINBURGH; 1, Walbrook, Mansion House, LONDON, or to the "Crown Wharf," Thomas Street, Limehouse, LONDON, where stocks of house, steam, and gas coal are always on hand.

Coal, machinery, fire goods, &c., shipped to all parts of the world.

LESMAHAGO GAS COAL,

AUCHINHEATH COLLIERY,

LESMAHAGO N.B.

JAMES FERGUSON & CO.

LESSEES SINCE 1832.

LONDON AGENTS:
JAMES LAWRIE & CO.,
63, OLD BROAD STREET, E.C.

CONTINENTAL AGENTS:
LA COUR & WATSON,
LEITH.

GEORGE GLOVER AND CO.,

Patentees of the Standard Gasometers for the Government,

TWO MEDALS,

LONDON, 1862.

HAVE OBTAINED THE

HIGHEST

PRIZE

FOR

SILVER MEDAL,

PARIS, 1867.

IMPROVED DRY GAS-METERS AND GASOMETERS,

AT THE

PARIS EXHIBITION.

RANELAGH WORKS, RANELAGH ROAD, PIMLICO, LONDON, S.W.;

AND 236, GEORGE STREET, GLASGOW.

HENRY HOWARD & CO.,

COOMBS WOOD PATENT TUBE-WORKS.

OLD HILL, near DUDLEY,

MANUFACTURERS OF

HOWARD'S PATENT IMPROVED WROUGHT-IRON TUBES,

FOR GAS, STEAM, AND WATER;

Also ORDINARY WELDED WROUGHT-IRON TUBES and FITTINGS,

FOR GAS, STEAM, & WATER, EITHER BLACK, GALVANIZED, OR ENAMELLED.

CORE BARS FOR IRONFOUNDERS, STOCKS, TAPS, AND DIES, IRON COCKS, &c.

London Agent—W. G. DAVIS, 2, Brabant Court, Philpot Lane, E.C.

SILVER MEDAL, PARIS EXHIBITION, 1867.

LLOYD AND LLOYD,

ALBION TUBE-WORKS, BIRMINGHAM,

MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS

For Gas, Steam, Water, &c.

SOLE LICENSEES AND MANUFACTURERS for the United Kingdom of

THE LAVENANT PATENT ENAMELLED TUBES AND FITTINGS.

LAP-WELDED IRON & HOMOGENEOUS METAL TUBES

For Locomotive, Marine, and Stationary Boilers.

Boiler-Tube Ferrules, Gun-Metal Gland Cocks, Water-Gauges, Whistles, &c.; Stocks, Taps, and Dies for Screwing, and Gas-Fitters Tools of all kinds.

London Offices: No. 4, Cloak Lane, Queen Street, E.C.

WAREHOUSES:

LONDON: No. 157, Upper Thames Street, E.C. LIVERPOOL: No. 63, Paradise Street. MANCHESTER: Barlow's Croft, Chapel Street, Salford. PARIS and LILLE.

LAMBERT BROTHERS, WALSALL.

ALPHA TUBE & FITTING WORKS

R. LAIDLAW AND SON,

EDINBURGH AND GLASGOW.

Manufacturers of

CONSUMERS IMPROVED WET GAS-METERS,

THE UNVARYING WATER-LINE GAS-METERS,

IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;

STATION-METERS, ALL SIZES, up to 15 feet Square, with PLANED JOINTS;

Experimental Meters, Photometers, Pressure-Gauges,

Governors, Test Holders, &c., &c.

LONDON OFFICE: 106, CANNON STREET, E.C.

TRADE MARK.

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

CROWN TUBE-WORKS,

WEDNESBURY, STAFFORDSHIRE.

WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;

LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;

HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.;

GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM.

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

London Agent: W. G. DAVIS, 2, BRABANT COURT, PHILPOT LANE, E.C.

PARIS, 1867.

CLASSES 24 and 53.

WILLIAM SUGG,

GAS ENGINEER.

LONDON, 1862.

CLASSES 13 and 31.

PUBLIC LAMP GOVERNORS, LEVER COCKS, AND POLE LIGHTERS,

LAMP METERS AND BOXES.

IMPROVED LOWE'S JET PHOTOMETERS.

VINCENT WORKS, VINCENT STREET, WESTMINSTER, S.W.

1862.

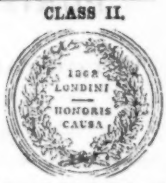
PATENT ANTIMONY PAINT.

MADE ONLY BY

GEORGE HALLETT & CO.,

296, ROTHERHITHE, LONDON, S.E.

CLASS II.



This Paint having been in general use over eleven years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known.

It is not discoloured like white lead in a sulphuretted atmosphere, nor washed off like white zinc; and its light colour reflecting heat, produces much less expansion of gas in holders painted with it than with dark colours, besides rendering them much more sightly. Its specific gravity is so much below white lead that the same weight will cover one-third more surface, while it is equal in body; and its price being about the same (30s. per cwt.), it is actually one-third cheaper. From experience, its manufacture is greatly improved, and it is quite suitable for all purposes in which white lead is employed.

Reference is kindly permitted by the Engineers of the City of London, Commercial, London, and Surrey Consumers Gas Companies, who pronounce it the best Paint known for their purposes.

N.B.—Antimony Paint, COVERING SO MUCH MORE WORK, costs about 20s. per cwt., as compared with White Lead at 30s. per cwt.; a similar economy arises from its use in Steam and Gas Joints, for which purpose it is superior to White Lead.

TO ENGINEERS, GAS COMPANIES, RAILWAY COMPANIES, &c.

THE TORBAY PAINT COMPANY,

SOLE PROPRIETORS OF

GOVERNMENT PATRONAGE, ADMIRALTY & WAR OFFICE.

CALLEY'S GENUINE "TORBAY" PAINT

AND

THE ANTI-GALVANIC PAINT.

THESE PAINTS ARE SPECIALLY PREPARED, and are most valuable for protecting and arresting rust on all ironwork, AND WILL COVER TAR EFFECTUALLY; they adhere strongly, acquire great solidity, do not crack, flake off, or blister by heat, and they resist the effects of SULPHUROUS AND GASEOUS EXHALATIONS.

They are used extensively at a large number of GAS-WORKS, on Gasholders, Purifiers, and all classes of Ironwork; also by Government, Railway Companies, &c.

Our CIRCULAR will be forwarded on application. SAMPLE CAN, for trial, sent free of charge.

Works: Brixham, Torbay, Devon,

STEVENS & CO., 21, GREAT WINCHESTER STREET, LONDON, E.C.

THE FARNLEY IRON COMPANY, LIMITED,

FARNLEY, near LEEDS,

MANUFACTURERS OF

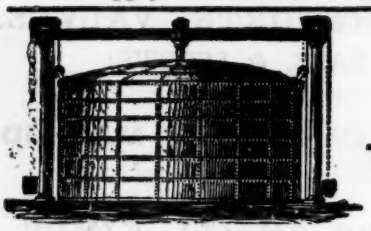
FIRE-CLAY GAS-RETORTS & FIRE-BRICKS,

Of every size and shape, and of the best quality; also of White and Coloured GLAZED BRICKS, SANITARY PIPES, &c., &c.

The F. I. Co. have the exclusive right to make and sell Fraser's Patent "Ribbed" Gas-Retorts in Fire-Clay.

In order to meet the constantly increasing demand for their Gas-Retorts, the F. I. Co. have recently made such an addition to their premises as will enable them to execute expeditiously the largest home or foreign orders.

Apply as above, or to the London Offices, 15, NEW BROAD STREET, E.C.



IMPROVED GAS APPARATUS,

FOR CITIES, TOWNS, VILLAGES, &c.,

INVENTED AND MANUFACTURED BY

W. C. HOLMES & CO.,

WHITESTONE IRON-WORKS, HUDDERSFIELD.

SOLE MANUFACTURERS of B. W. THURSTON'S IMPROVED SCRUBBER, CONDENSER, and WASHER, in use in many of the principal Gas-Works on the Continent.

PATENTEES of the IMPROVED COMBINED PURIFYING APPARATUS, so eminently adapted for Exportation.

ESTIMATES, PLANS, and SPECIFICATIONS PREPARED for BUILDINGS and APPARATUS.

Prospectus, Price Lists, &c., on application.

LONDON OFFICES—57, GRACECHURCH STREET, CITY.

*** *Please address letters to Huddersfield.*

REFERENCES TO UPWARDS OF 300 GAS-WORKS.

DANIEL HOWARD,

Successor to the late BENJAMIN WHITEHOUSE,

(ESTABLISHED IN 1765,)

BOILER AND GASHOLDER WORKS,

Westbromwich, near Birmingham.

MANUFACTURER OF TELESCOPE AND SINGLE GASHOLDERS,

WROUGHT & CAST IRON TANKS

FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS,

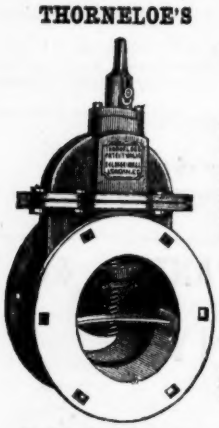
And all kinds of GAS APPARATUS.

Wrought-Iron Roofs, Bridges, and Girders; Steam, Hot Water, and Range Boilers; Tanks, Cisterns, &c.,

And all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, and ESTIMATES FURNISHED.

THORNELOE'S



PATENT VALVE.

THORNELOE & COCHRAN,

GAS ENGINEERS AND CONTRACTORS,

SOLE MAKERS OF

CHANDLER AND SON'S

PATENT REGULATING DIP-PIPE.

Copy Testimonial.—A series of experiments have taken place at the Erith Gas-Works with "Chandler's Patent Dip-Pipe," which was found to prevent any deposit of carbon taking place at the back or on the surface of the clay retorts; there was also considerable increase of gas per ton of coal carbonized, whilst the apparatus continues working with the greatest simplicity and certainty.

Prospectus, with Price Lists and Particulars, on Application.

THORNELOE'S PATENT VALVE

For GAS and WATER, from 3 to 24 inches,

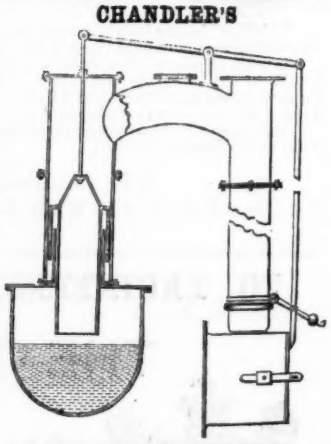
SUPPLIED FROM STOCK.

They are now in use at the following Gas-Works in London:—PHŒNIX and SOUTH METROPOLITAN; also at Aylesbury, Aldershot, Colchester, Farnham, Guildford, Leicester, Ilford, Middlesboro' Patent Gas Company, Reading, &c.

ADDRESS—

34, LONDON WALL, LONDON, E.C.

CHANDLER'S



PATENT DIP-PIPE.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 42, Parliament Street, WESTMINSTER.

THOMAS PROUD,

Brookfield Works,

103, ICKNIELD STREET EAST, BIRMINGHAM,

MANUFACTURER OF

WOOD GRIDS

FOR PURIFIERS AND SCRUBBERS,

AND

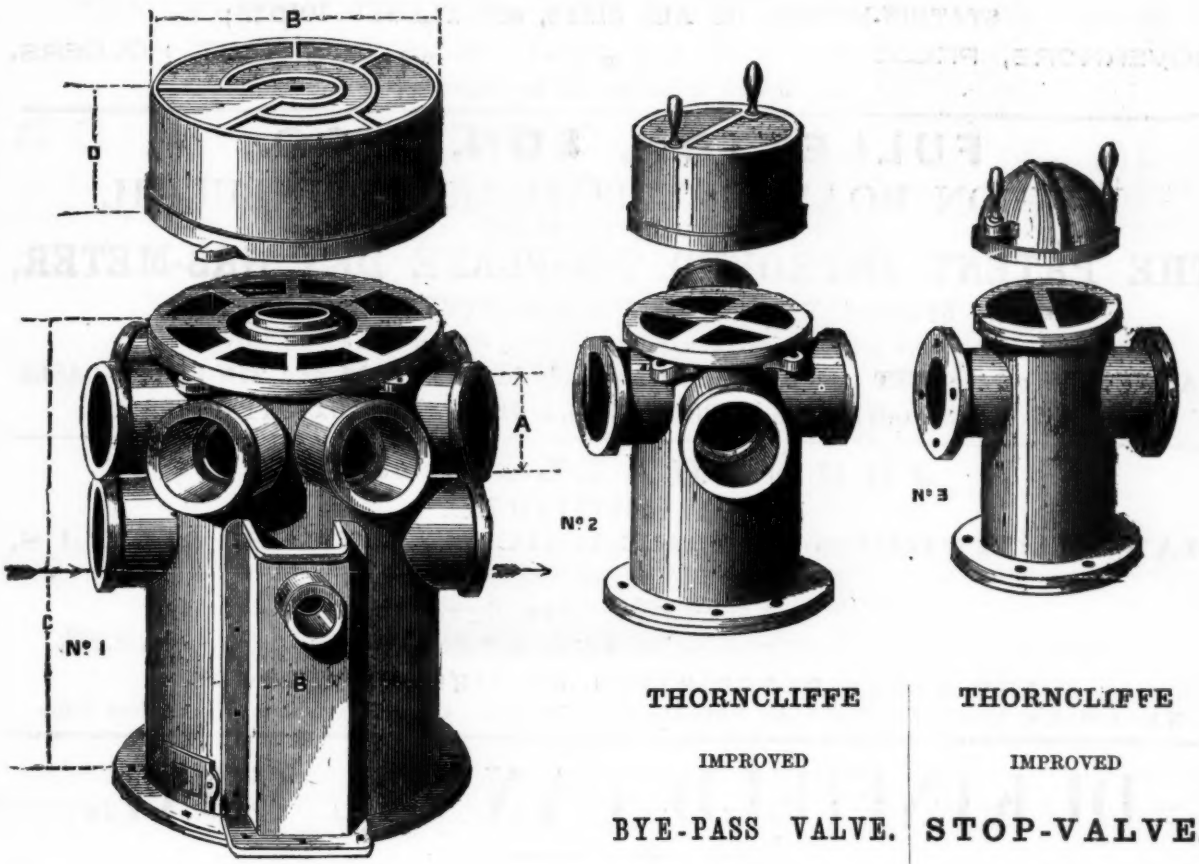
CONTRACTOR FOR GAS APPARATUS & MAIN-LAYING.

THE THORNCLIFFE IMPROVED CENTRE-VALVE,

MANUFACTURED BY

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD.



Sizes of the

THORNCLIFFE IMPROVED CENTRE-VALVE.

		Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
A	Bore of Pipe...	4	5	6	7	8	9	10	12
B	Diam. of Body.	16	20	23	26	28	31	34	40
C	Height of Tank.	33	35	38	43	46	48	51	56
D	Depth of Cover.	8	9	10	11	12	13	14	16
	Total height...	41	44	48	54	58	61	65	72

THORNCLIFFE IMPROVED BYE-PASS VALVE.

SIZES

From 3 ins. upwards.

THORNCLIFFE IMPROVED STOP-VALVE.

SIZES

From 3 ins. upwards.

In all cases the Covers are cast heavy enough to resist any required pressure.

The advantages derived from the adoption of these Valves are so manifest and cardinal that in the immediate character of the change—the simplicity of the machine—the facility affording for cleaning out connexions between Valve and Purifier—the perfect collection and delivery by suitable overflow of the ammonia, at a greatly diminished depth from ground-line over the old form of Valve—the advantage of connecting on the same level, and at any angle, or opposite to each other, the inlet and outlet pipes without dip or rise—the clear acquisition of space in the purifying-house, by being able to place the boxes nearer together, the new Valve being entirely under the floor—and lastly, though of the greatest importance, the passage of crude and unpurified gas during the change is minimized to the merest fraction, thus preventing the fouling by impure gas the delicate machinery and easily affected exposed movements of the station-meter, thereby preventing the introduction of the enemy (unpurified gas) into the gasholder. Also a dead abutment is offered to all back pressure, imparting thereby to the gauges, governors, and hydraulic seals, a steadiness of action never realized with the once famous, but now fast becoming obsolete, Hydraulic Centre-Valve.

N., C., and Co. also Manufacture and Erect

PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.

London Office—34, LONDON WALL, MOORGATE STREET, E.C.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS,

And all kinds of Experimental Gas Apparatus.

FULLERTON, SON, & CO.,

LONDON ROAD METER-WORKS, EDINBURGH,

SOLE MANUFACTURERS OF

THE PATENT IMPROVED TIN-PLATE DRY GAS-METER,

WITH SPECIAL FACILITIES FOR ADJUSTMENT AND REPAIR,

The principal parts of the mechanism being accessible by the removal of a single Screw.

GAS-METERS on the WET and DRY principles made in CAST-IRON and TIN-PLATE CASES.

STATION-METERS, GOVERNORS, EXPERIMENTAL & TEST METERS, GAS APPARATUS, &c.

JOHN HALL & CO.

STOURBRIDGE,

MANUFACTURERS of FIRE-BRICKS, LUMPS, & TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

DUKINFIELD CANNEL COAL.

THE DUNKIRK COAL COMPANY.

OFFICES:

ASTLEY DEEP PIT, DUKINFIELD.

ANALYSIS, PRICES, AND OTHER INFORMATION, ON APPLICATION AT THE ABOVE OFFICES.

Established

1795.

JOSEPH CLIFF & SON,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

MANUFACTURERS OF ALL DESCRIPTIONS OF

FIRE GOODS, and Salt-Glazed Drain-Pipes.

LONDON WHARF:

Wharf No. 4, inside Great Northern Goods Station, King's Cross, N.;

LIVERPOOL—1, Back Leeds Street,

Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.

TANGYE BROTHERS & HOLMAN,

10, LAURENCE POUNTNEY LANE, LONDON, E.C.,

SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH

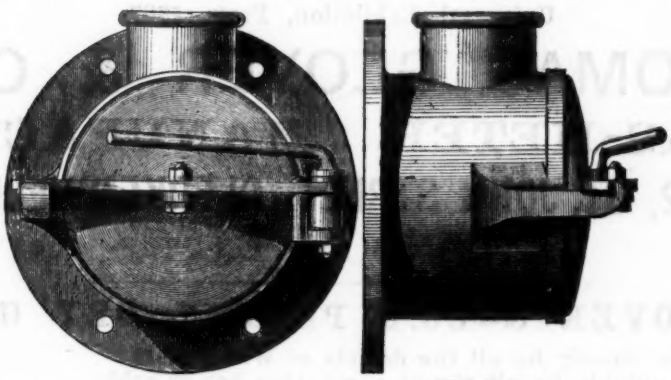
HOLMAN'S PATENT ECCENTRIC FASTENINGS.

OVER 7000 IN USE.

NO LUTING.

LIDS HINGED TO MOUTHPIECES; NO LIFTING ON OR OFF.

NO SCREWS FOR FASTENING.



FRONT VIEW. SIDE VIEW.

SIMPLE.

ECONOMICAL.

DURABLE

EFFECTIVE.

NO DUPLICATE LIDS REQUIRED.

These Lids are proved by many eminent Gas Engineers to be the most efficient, saving much time, labour, and expense; are opened and closed as quickly and with as little trouble as an ordinary furnace door, and by their use the Retorts are soundly sealed during the whole period of carbonization.

THESE LIDS ARE IN USE AT THE FOLLOWING (AMONG MANY OTHER) GAS-WORKS:—

The Gaslight Company, Beckton (where over 2000 are in use).	The Gas-Works, Royal Arsenal, Woolwich.	The Nottingham Gas-Works.
„ Gaslight Company, Bow Common.	„ Alliance and Dublin Gas-Works.	„ Newcastle-on-Tyne Gas-Works.
„ London Gaslight Company.	„ Edinburgh Gas-Works.	„ Carmarthen Gas-Works.
„ Independent Gaslight Company.	„ Manchester Corporation Gas-Works.	„ Merthyr Tydfil Gas-Works.
„ Phœnix Gaslight Company.	„ Salford Corporation Gas-Works.	„ Ystrad Gas-Works.
„ South Metropolitan Gaslight Company.	„ Rochdale Corporation Gas-Works.	„ St. Alban's Gas-Works.
„ West Ham Gas Company.	„ Liverpool United Gas-Works.	„ Over Darwen Gas-Works.
	„ Birkenhead Gas-Works.	„ Aylesbury Gas-Works.

The Morton's Lid is made circular in form, that being the most convenient and suitable shape. It can be used for Retorts of any section, by adapting the Mouthpiece casting from the D, oval, or other shape, at the back, to circular in front.

The following important Testimonial, among others, has been given:—

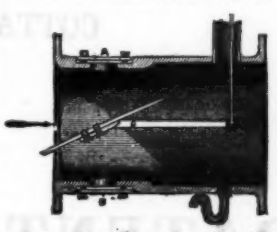
The Gaslight and Coke Company. Engineer's Office, 6, Westminster Chambers, Nov. 14, 1871.

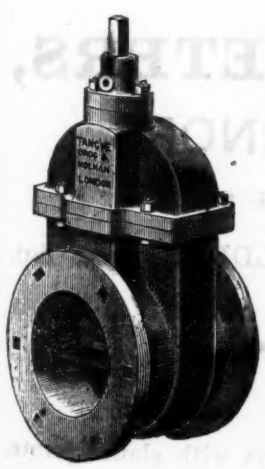
Dear Sir,—In reply to your inquiry, I have the pleasure of stating that the whole of the Mouthpieces at Beckton have Morton's Lids attached to them, and they have given us every satisfaction. We have 2160 in use.—I remain, yours truly, (Signed) F. J. Evans.

SOLE MAKERS OF

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communication being avoided by placing the Lever or Radius Arm (shown at C on the drawing) inside the Valve-Chamber, upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.





London Gas-Works, Nine Elms, Dec. 25, 1871.

Gentlemen,—The 18-inch Hunt's Patent Throttle-Valve Governor supplied by you to this Company has been in use for about six months, working very satisfactorily; it obviates entirely the oscillation which sometimes occurs with the ordinary Governors, with the annoyance and danger arising therefrom. The efficiency of this Instrument, together with its compactness and lowness of price, ought to ensure its general adoption.

Messrs. Tangye Brothers and Holman. (Signed) Robert Morton, *Engineer.*

TANGYE BROTHERS AND HOLMAN

Have in Stock, and ready for immediate delivery, the following GAS-VALVES:—

20 3-inch Rack Valves.	9 6-inch Screw Valves.	13 10-inch Screw Valves.
7 4 „ Screw Valves.	14 8 „ „	12 12 „ „
10 5 „ „	10 9 „ „	14 14 „ „

CLELAND'S PATENT DIRECT STEAM-JET EXHAUSTERS.

TRAVELLERS AND HYDRAULIC LIFTS FOR PURIFIER-LIDS, &c.

London 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF

PATENT WET & DRY METERS,

STATION-METERS AND GOVERNORS,

PRESSURE REGISTERS, GAUGES,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c., &c.

WATER METERS.

W. P. & Co. beg to state that they are now prepared to supply Station-Meters with planed joints.

CONTENTS.

Circular to Gas Companies:—
Lord Redesdale and Gas Legislation . . . 497
Opposition to the Chartered Gas Bill in the House of Lords . . . 497
Forthcoming Meeting of the British and North British Gas Managers Associations 497
Mr. Wills's Lecture at the Society of Arts . . . 498
Poisonous Properties of Carbonic Oxide . . . 498
Accident at Manchester . . . 498
The Oxybydric Light at Buffalo, U.S. . . . 498
Correspondence:—
Lord Redesdale and Gas Legislation . . . 499
Retort Charging and Drawing Apparatus . . . 499
Signal Light at the Houses of Parliament . . . 499
Parliamentary Intelligence:—
Progress of Bills in the House of Lords . . . 500
Progress of Bills in the House of Commons . . . 500
House of Commons Committee—Barrow-in-Furness Corporation Improvement Bill 500
Miscellaneous News:—
The Institution of Civil Engineers . . . 498
The Mutual Gas Company, Buenos Ayres . . . 503
Dunstable Water Supply . . . 503
Holden's Apparatus for Charging and Discharging Gas-Retorts . . . 504
Meeting of the Imperial Continental Gas Association . . . 505
Meeting of the Peterborough Gas Company . . . 506
Meeting of the New Gas Company . . . 506
Metropolis Gas Supply . . . 507
The Recent Gas Explosion at Manchester . . . 507
On some Recent Processes for the Manufacture of Gas for Illuminating Purposes. By T. Wills, F.C.S. . . . 508
Cheltenham Water-Works Company . . . 513
Extraordinary Explosion of Gas at Elderslie . . . 513
Consumption of Gas in New York . . . 513
Explosion of Gas at Northampton . . . 513
Advances in the Price of Gas . . . 514
Explosion of Gas at Manchester . . . 514
Public Lighting at Boston . . . 514
Sale of the Belfast Gas-Works to the Corporation . . . 514
The Kromschröder Gas . . . 514
Register of New Patents:—
Ruck, W. D.—Manufacture of Gas . . . 514
Harrison, C. W. and A. H.—Combining Atmospheric Air and Gases for Lighting, &c. 515
Applications for Letters Patent . . . 515
Grants of Provisional Protection . . . 515
Notices to Proceed . . . 515
Patents which have passed the Great Seal . . . 515

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

NOTICE TO SUBSCRIBERS.

SCALE OF CHARGE FOR ADVERTISEMENTS.

Six lines and under . . . 3s. 0d.
Sixpence per line for every line additional.
Special contracts for advertisements intended for continuous insertion.

The JOURNAL has been duly registered at the General Post-Office for transmission abroad.

All communications for the Editor, remittances for subscriptions, and orders for advertisements should be addressed to the publisher, William B. King, 11, Bolt Court, Fleet Street, London, E.C.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 3, 1873.

Circular to Gas Companies.

We are happy to see that Lord Redesdale's resolutions are attracting the serious attention of gas companies. The more they are considered the more unfair they appear. We insert in another column a letter from a well-known member of the gas community, who calls particular attention to the unconstitutional character of his lordship's proceedings. The resolutions which have been adopted by the House of Lords commit that House to a contest with the House of Commons. Bills have passed the latter House, with provisions agreed to after much investigation and deliberation, and by the resolutions the Lords say they will not pass these Bills without alterations—we cannot in this case say amendments. Now, if a very few Lords are to dictate to the House of Commons the course they shall take with regard to private Bills relating to business matters, the sooner the constitution of the House is changed the better. We hope, however, that on such a matter as this, when these Bills are returned, some member of a committee who have passed them will have the courage to move that the Lords amendments be *not* agreed to, and that the House of Commons will consistently maintain its position in the conference which will ensue from the rejection of the amendments. Our correspondent very correctly points out that a contest like this would never have been provoked on a measure affecting a powerful interest like the railway companies. It is the weakness of gas companies which makes them fair game for Lord Redesdale. We are far from thinking that a majority of his peers would endorse the proceedings of the noble lord if they could only be persuaded to give attention to the matter. But, unfortunately, three lords make a House, and it is only on particular occasions that many can be got together. On the question now raised, however, gas companies may well address themselves by petition specially to the House of Lords, and so endeavour to ascertain whether any sense of justice can be aroused in the minds of its members.

The vestry of St. George's, Hanover Square, in their contest with the Chartered Company, have enlisted the sympathy of Lord Redesdale, who has engaged himself in some correspondence with the chairman on the subject, and his lordship has obtained the suspension of a Standing Order to allow the vestry to be heard against the Bill. Why the vestry should interfere, except to squander the ratepayers money, is more than we can see. The Metropolitan Board of Works are opposing the Bill of the company in the Upper House, and they have never shown any lack of hostility to gas companies. A petition presented by the vestry embodies a number of details quite foreign to the subject of the Bill promoted by the company, while some of the allegations it contains are the reverse of facts. The real prayer of the petition is that the Act of 1860 may be maintained; and the fact is that under the provisions of the Act of 1868 the public are better served than they ever were before. By the former Act 12-candle gas was prescribed, the vestry is now supplied with gas seldom under 17 candles. The Act of 1860 allowed five grains of ammonia in 100 feet of gas; now gas practically free from ammonia is supplied. In 1860, 20 grains of sulphur were permitted in 100 feet. For more than a year past the bulk of the gas delivered by the Chartered Company has rarely had more than 12 grains of sulphur; and from the 30th of this month an order of the referees, which has all the force of a penal enactment, makes it obligatory on the company to furnish gas with less than 20 grains of sulphur from all their stations. Thus all, and a great deal more than the vestry ask for, is already secured; and as regards testing, it will be admitted by all conversant with the matter, that gas was never subjected to such stringent tests as it is now in the metropolis. We are, therefore, quite at a loss to see the object of the proceedings of the vestry; equally are we at a loss to account for the line adopted by Mr. Leslie, the prime mover in the antagonism of the vestry. He has, in his time, done good service to gas companies, and better service to the public. In the construction of his "mouse-trap" burner he nearly hit upon the true principles involved in the consumption of gas to the best advantage. But more economical and better light-producing burners have since been invented, and the Leslie burner is almost forgotten. It receives now, we fancy, its single application in the Letheby apparatus for the estimation of sulphur, the use of which was contemplated, though not prescribed, by the Act of 1860. We shall wait the result of this opposition with much curiosity, but with the firm conviction that the Commons will not stultify themselves by agreeing to a measure essentially different to that they passed.

At Edinburgh, on Tuesday, the 10th inst., will commence the conjoined meeting of the British and North British Associations of Gas Managers, under the presidency of A. A. Croll, Esq. We hope and expect that the meeting will be largely attended, for the attractions are unusually great. Our Scottish friends have resolved that nothing shall be wanting upon their part to render the visit of gas managers to the northern metropolis a great success. In conjunction with the Secretary of the British Association, who has recently visited Edinburgh to assist in the necessary arrangements, they have prepared for their expected visitors a most hospitable reception. On the evening of Tuesday, the 10th, after the close of the business proceedings of the day, a *conversazione* will take place in the celebrated Industrial Museum connected with the University, and on the following evening a banquet is to be given in the large hall of the Masonic Society, in George Street. We understand that about 250 members have already accepted the invitations, so that a good representation of the society is sure to be made on this occasion. We have been desired to state that from changes of residence or deficient addresses some invitations have not reached their intended destinations, and that those members who have not received them, should apply at once to Mr. Fraser, Inverkeithing, for tickets. Mr. Ronald Johnstone, civil engineer, Glasgow, and a successful coalmaster, is to occupy the chair; Mr. Fraser, Inverkeithing, will be croupier; and the committee of subscribers will be efficient stewards. The list of papers to be read during the sittings presents for discussion subjects of very general interest to gas managers. The necessity in these days of making the most of residuals gives importance to a paper like that of Mr. Eldridge, which will evoke opinions as to the best method of producing a valuable and marketable article from ammoniacal liquor. A paper by Mr. Warner, of South Shields, will treat of the distribution of gas, and the importance of having a complete and perfect register of distributing plant. Stoppages in ascension-pipes are still a difficulty, and any suggestion Mr. Parlby can make for avoiding them will be listened to with interest. The coal wasted in gas-works is a matter well worthy of attention, and at the hands of Mr. Methven is certain to receive a practical consideration. Gas companies, and the public also, are just now much exercised on the subject of lost or unaccounted-for gas, and the matter is sure to provoke an interesting and useful discussion. Gas street lighting needs improvement, and Mr. Skelton will show how easily some improvements may be made. The extension of the use of coal gas as fuel is a thing greatly to be desired, and we are glad to see a practical man like Mr. Hartley giving serious attention to the matter. In Paris, where gas is much dearer than in London, the day consumption for fuel makes rapid progress, as it will no doubt in this country when the advantages are more widely known. The paper "On Standard Gas-Burners" is from the hands of a master of the subject, Mr. Sugg, and is certain to be complete and exhaustive. A plain system of book-keeping for gas companies is a desideratum, and Mr. Frith's suggestions are sure to receive attention.

Substitutes for coal in the manufacture of gas are just now matters of popular interest, and a review of the merits of rival schemes, by Mr. Gore, will have an obvious value. The continual disputes which occur will give much interest to the paper by Mr. Randall, "On the "Computation of Gas Accounts arising from the Non-Registration of "Gas-Meters." The remaining papers, already announced, "On Gas-"holder Capacity compared with Consumption," by Mr. Jones, Dover; "On a New Compensator and Bye-pass," by Mr. Laidlaw; "On "the Construction and Choice of Materials for Gas Apparatus," by Mr. Dempster; "On the Flow of Gas through Pipes," by Mr. Paterson are all on subjects possessing much interest; while Mr. Anderson's descriptions of novel apparatus and their use in the purification of gas, coming from a practical and scientific gas manufacturer, are sure to command attention. We must not omit to mention the lecture to be delivered by Dr. Stevenson Macadam, "On the Physico-Chemical Properties of Gases," a subject of great interest and importance, which is certain to be ably treated of, and experimentally well illustrated by the lecturer. After all this serious work, the members will deserve some recreation, and their Scottish brethren have with great liberality cut out for them an excursion which needs only fine weather to make it most enjoyable. The excursion will pass through fine lowland scenery to Helensburgh, there embark on the magnificent river Clyde, sail up Loch Long—a sea lake—where mountains soar 2000 feet high from the very edge of the loch. The visitors will then walk over to Loch Lomond (less than a mile), which is the largest lake in Britain, and has on its edge the celebrated mountain of Ben Lomond. This is the country of the famous freebooter Rob Roy, celebrated in Sir Walter Scott's novels. At the south end of the lake the train will meet the party, who will thence return to Edinburgh. Strangers to Highland scenery will thus gain within the limits of one day's excursion the most varied and sublime glimpses of nature which the world possesses. If our advice reaches any member who is hesitating, we recommend him to make up his mind at once, and go to what promises to be one of the most useful and pleasurable meetings of the Association.

In a lecture delivered to the Society of Arts on Wednesday, the 21st ult., and reported in another place, Mr. Wills submitted to a fair review the several schemes afloat for producing illuminating gas by carburetting atmospheric air and other gases by means of light petroleum spirit. Holding, as we do, firmly to the opinion that no one of these inventions is likely to succeed in any large gas undertaking, we are willing to believe that some day they may possibly be made applicable to domestic supply. This stage of success, however is not yet reached. We referred to the failure at Chichester in our last, and the notice we are able to give of the Kromschroeder experiment at Marlow shows that, somehow or other, the manufacture of air gas cannot be completely dissociated from the manufacture of coal gas. All the inventions, it is clear, are still in the experimental stage, and it is impossible to predict what form they may eventually take. In the meantime, the material, the employment of which is common to all—namely, light petroleum oil or spirit—must attract great attention. It is the common assertion of each rival inventor that the supply of this spirit is practically inexhaustible—that, being a waste product, it is ridiculously cheap. A speaker at the Society of Arts said it was so difficult to get rid of that it was thrown into rivers—a statement that made us wonder no Pennsylvanian stream had been set on fire—and that it was poured into wells, only to be pumped up again, we presume. A statement, however, in the *American Gaslight Journal* suggests a doubt of the truth of these stories. According to our contemporary, the proportion of light spirit obtained from Pennsylvanian oil is only 10 per cent. of the crude oil; and calculating that it would take three gallons of such spirit to produce 1000 feet of gas equal to coal gas, our contemporary asserts that New York alone, if lighted by one of the new processes, would absorb five months product of the entire Pennsylvanian oil region. We are not told whether the Canadian oil differs materially in this particular from the American, but we think we may assume that it does not; and hence it seems clear to us that so soon as a steady demand for this light oil springs up, the price will rapidly rise. It will then be seen whether under any circumstances these carburetted gases can compete in point of cheapness with coal gas.

Another point referred to by our contemporary throws some light on the cause of the failure at Chichester. "A gallon of naphtha," it is remarked, "very poorly naphthalizes 1000 feet of air. From "double to quadruple this proportion is required before the air will "give any light when burned from common jet burners; that is, with-"out a chimney." Now, all the experiments seem to prove that a gallon of oil just about saturates air with vapour at common temperatures, and that to get more would require heat to volatilize the oil and to maintain it in a state of vapour. Hence conditions impossible to be realized are required for the distribution of this richer gas over even very limited areas. We have ourselves had the opportunity of seeing that the light oil, vaporized by the application of heat, will scarcely travel to the end of a large room in very cold weather. A severe winter would, we expect, bring about a collapse of all the schemes.

We must demur to the statement made by Mr. H. P. Stephenson at the Society of Arts, on the strength of some experiments made by Dr. Frankland and Mr. Wright, that carbonic oxide is not more poisonous than carburetted hydrogen, or, as we may say, common coal gas. We do not remember to have met with an account of the experiments referred to, but we may here collect together the statements of various authorities which show conclusively that carbonic oxide is one of the most poisonous gases known. In the first place, Dr. Frankland himself, in his lectures on coal gas (JOURNAL OF GAS LIGHTING, &c., vol. xvi. p. 327), says that 2 per cent. of carbonic oxide in air constitutes a poisonous mixture. In 1802, Clement and Desormes found that carbonic oxide undiluted killed animals instantly, and caused giddiness and faintness to themselves when breathed in air. (*Annales de Chimie*, vol. xxxix., p. 56, and Thomson's "Chemistry," vol. i., p. 561.) In 1811, Nysten, and in 1812, Sir H. Davy, found that when the gas was largely diluted with air it produced a sort of intoxication, followed by faintness. (Nysten, *Recherches Chemico-physiologiques*, p. 88 *et seq.*, and Sir H. Davy, Works, vol. iv., p. 224.) In 1814 the two assistants of Mr. Higgins, of Dublin, were nearly killed by it. ("Christison "on Poisons," p. 828.) In 1840, Leblanc, in conjunction with Dumas, made experiments with it, and found that 1 per cent. in air would kill a small dog in a minute and a half; 5 per cent. in air killed birds immediately. (*Annales d'Hygiène Publique*, vol. xxix., p. 54. "Christison on Poisons," p. 828.) In 1840, Selligue proposed the use of "water "gas" (containing about 34 per cent. of carbonic oxide) for lighting the city of Strasburg. His proposition was adopted, and one night it escaped into a baker's shop, and proved fatal to several persons. Shortly after this, Delcourt, the French aëronaut, used water gas to inflate his balloon, and he had hardly taken his seat in the car when he fell insensible. Those who approached him to render assistance fainted, and fell likewise. (*Annales d'Hygiène Publique*, vol. xxix., p. 52, and "Christison on Poisons," 828.) More recently, the experiments of Adrian Chenol (1846), of Professor Tourdes (1854), and of Dr. Letheby (1862), have demonstrated its poisonous properties. Dr. Letheby found that air containing only 0·5 per cent. of carbonic oxide killed small birds in about three minutes, and a mixture of 1 per cent. killed them almost immediately. Our readers may also refer to Pelouze's report to the Municipal Council of Paris, on Kirkham's Water Gas, in the JOURNAL OF GAS LIGHTING, vol. iii., p. 530 (Sept. 11, 1854), which embodies some of the facts we have quoted above. It was on the receipt of this report that the council forbade the distribution of what was then "new gas" in Paris. Lastly, we may mention that Mr. Gamgee avails himself of the poisonous properties of carbonic oxide to kill animals intended for food. After one inspiration of the gas, a bullock falls as if shot through the brain.

A lamentable accident at Manchester has been made the subject of much fine writing, while the evidence given at the inquest, reported to-day and in our last, involves some mystification. The accident was a very sad but a very ordinary one. It is clear to us that the man Eachus, perhaps laudably desirous not to waste more gas than was absolutely necessary, neglected to pass it a sufficiently long time through the "syphon pot" to displace all the air it contained. To completely dislodge the air from a vessel of the dimensions of this pot would require gas to be passed from a 1¼-inch pipe for several minutes. The joints on trial were found to be sound; but, as soon as the gas-pipe was disconnected, a light being close by, the explosive mixture in the pot was fired, with the disastrous results reported. The accident is greatly to be deplored, but it is illustrative of no new danger to inquisitive people in the streets. Care will be taken by the engineers of the Corporation of Manchester that the joints of syphon pots are for the future tested in a different way, and the matter will soon be forgotten by all but the friends of the two persons unhappily killed. The mystification we allude to was the endeavour to show that no light was brought near the syphon. Such explosions never occur spontaneously, and it would have been better to have admitted the truth.

The oxyhydric light scheme in Buffalo, U.S., has collapsed, from want of patronage its promoters aver, and the last moments of the supply were made remarkable by the occurrence of some accidents which illustrate the danger incurred in the supply of the two gases. At the Academy of Music, it seems that an imperfectly connected burner allowed the carburetted hydrogen gas to leak down into the oxygen meter. The result, when the gas came to be lighted, may be guessed. In a few days a second accident of a similar kind happened at the same place. In like manner a defective burner in a street-lamp allowed hydrogen to pass into the oxygen main under the street, and somehow or other the mixture got ignited, causing much astonishment to the inhabitants of Buffalo, and considerable damage to the roadway. Buffalo is the first, and we believe the only place in which a double main has been laid, and oxygen sold by meter, and the results are unfortunate for the Oxyhydric Light Company.

THE INSTITUTION OF CIVIL ENGINEERS.—On Tuesday evening, May 27, Mr. Hawksley, the president of this Institution, and Mrs. Hawksley, received the members and their friends at a *conversazione* in the International Exhibition, South Kensington. A brilliant company was invited to meet them, the distinguishing feature of last year's reception—the presence of ladies in large numbers—being repeated. The arrangements made for the reception of his numerous guests amply sustained the president's well-known liberality. Entering by the west orchard-house at Queen's Gate, the visitors ascended the north-west staircase, each person in passing being presented with a specially prepared catalogue of the pictures and other works of art in the western galleries, where the promenade took place. These galleries and all their approaches were admirably lighted, and were profusely decorated with choice flowers and shrubs contributed from the Horticultural Gardens. In the first, Mr. and Mrs. Hawksley, supported by Colonel Manby and other members and officers of the Institution, received the company, which numbered in all nearly two thousand, amongst whom were His Serene Highness Prince Teck, the Duke of Sutherland, and members of all the learned professions. The band of the Royal Artillery, stationed in the central gallery, delighted the visitors with their excellent performances during the evening. Passing from the picture galleries, the visitors descended the south-west staircase into the machinery courts, where the machinery in motion was courteously explained by the different exhibitors in attendance. The adjacent parts of the Horticultural Gardens were illuminated with Chinese and other lanterns, and here there was a display of locomotive and traction engines. In several parts of the galleries and rooms beneath refreshments were provided on a most lavish scale; and the whole entertainment, while it reflected the highest credit on the hospitality of the hosts, seemed to give the most complete satisfaction and delight to all those who were honoured with invitations to be present.

Correspondence.

LORD REDESDALE AND GAS LEGISLATION.

SIR,—As a holder of gas shares, I have read with much interest your observations on the late very unjust and arbitrary resolutions passed by the House of Lords at the instigation of Lord Redesdale, the object of which is to prevent any committee, on the evidence adduced before them, to grant an increase in the price of gas limited by a former Act beyond such an amount as would allow a dividend in excess of 5 per cent. to the company applying for it.

It is well known that almost all gas companies in the kingdom are subject to the Gas-Works Clauses Act, passed after full inquiry in the year 1847, which allowed a dividend of 10 per cent. on their capitals, and authorized them at the same time to lay by a reserve-fund amounting to 10 per cent. on those capitals, in order to supplement any dividends of less amount.

Subsequently to the passing of that Act, when companies who had realized their maximum dividends have applied to Parliament for an increase of capital, it has been the habit to limit the dividend on such capital to 7 or 7½ per cent., and at the same time to fix such a price for the gas to be sold as, according to the evidence given at the time of the cost of coal and other materials used in the manufacture of gas, would be sufficient to enable the company to earn their maximum dividend, after which they were compelled to reduce the price of their gas to the public.

Subject to this legislation, a very large amount of capital has been invested in gas shares by persons of limited means at such a price as, on the average, would return them a dividend of about 6 per cent. on their investments, which, under Lord Redesdale's resolution, it is now proposed to cut into half, on the ground that the investment was made subject to the chances of any rise that might take place in the cost of labour and materials.

In proof, however, that this was not the case, I may refer to the most recent legislation which has taken place on the subject of gas supply to the metropolis—viz., to the Acts passed in the years 1868 and 1869, in relation to the Chartered, the Imperial, and the South Metropolitan Gas Companies, which legislation was the result of very long parliamentary inquiries before committees of both Houses.

By the provisions of those Acts (which have been constantly referred to since as *model* Acts) a price was limited for the gas to be supplied by the companies, sufficient (according to the evidence of the cost at the time of coals and other materials) to return the maximum dividend allowed to the companies (and which in the case of the Chartered Company amounted to 10 per cent. on the whole of their capital), but with a provision, that if, under the price so limited, the companies were unable, through an unexpected rise in coal or other causes, to realize their maximum dividend, with due care and management, they should be enabled to obtain an increase of price sufficient for that purpose, by proving their case to the satisfaction of arbitrators to be appointed by the Board of Trade.

It is not surprising that, owing to the late unprecedented and unexpected rise in the price of coal and labour, the Chartered Company have found themselves unable to maintain their maximum dividend, and have therefore availed themselves of this last-mentioned provision, and thereby obtained power to increase the price of their gas to the extent of 16 per cent. and upwards on the maximum price limited by their Act of 1868.

In the case of municipal corporations who supply gas, as at Manchester, and who are not limited by Parliament as to the price at which it is to be sold, a large increase of price has recently taken place, owing to the rise in the cost of coal, and if such an increase be justifiable in the case of these corporations, and in the case of the metropolitan companies before referred to, upon what principle should it be denied to other gas companies?

If the present price of coal had prevailed at the time when their Acts were passed, under which the price of their gas was fixed, is it within the verge of probability that that price would have been limited to a sum obviously insufficient to earn the dividend authorized by those Acts, or if it had been so, would it not obviously have been impossible to obtain the capital necessary to carry on the undertaking? The answer is self-evident, and, therefore, it must be plainly consistent only with common justice that the companies should be placed in as good a position now as they would have been placed in if the price of their gas were about to be now for the first time limited.

No one who is acquainted with private bill legislation can be very much surprised at any arbitrary course of proceeding adopted by Lord Redesdale, but it is really lamentable to observe that not one peer was found on the debate upon his resolutions to stand up in defence of common justice to the gas companies; indeed, from the observations which fell from some of them, it would appear that the only principle on which they consented to allow an increase of price sufficient to enable a gas company to earn even one-half of the maximum dividend to which they were entitled, arose from the apprehension that they might otherwise become bankrupt, and the public be thus deprived of a supply of gas altogether.

Now, I confess, it appears to me that these resolutions of the House of Lords are not only inconsistent with common justice, but that they are also manifestly unconstitutional; for they are intended to limit and control the action of both Houses of Parliament, on the dictum of a few peers, without inquiry, and to subvert the conclusions at which the committees of either House may have arrived upon the evidence adduced before them.

It is notorious that in the present session several gas companies have obtained power from the House of Commons to increase their charge for gas, on proof of the great and unexpected charges to which they have been put by the late extraordinary rise in the price of coal, yet the decisions of the committee by whom this increase has been sanctioned are to be set aside by a few peers, without inquiry, at the mere instigation of Lord Redesdale!

What would be said if that noble lord were to induce his brother peers at the beginning of a session to declare by resolution that they would not entertain any new gas or railway bill at all which contemplated a rise in the price, or in the tolls limited by a former Act? Surely such a resolution would hardly be tolerated by the Lower House, however readily it might be acquiesced in by those easy-going members of the Upper House who think that, having devolved on Lord Redesdale the charge of supervising their private bill legislation, they are absolved from all responsibility in relation to it, whether it be just or unjust.

The railway companies are strong and the gas companies are weak, so that it is more than probable that an injustice which would not be tolerated in the case of the former may be tamely submitted to in the case of the latter; but I have ventured to address these observations to you in the hope of drawing the attention of all gas shareholders to the subject, so that before the session closes they may bring it under the notice of the House of Commons, without which no gas bill, having for its object the raising of the price of gas, will have a chance of success in the ensuing session of Parliament. Q. C.

RETORT CHARGING AND DRAWING APPARATUS.

SIR,—With reference to the important paper which appears in your last JOURNAL as having been read before the Society of Engineers, on the 5th inst., will you allow me to supplement the same by the following description of what I have myself witnessed, from time to time, of the actual working of the pair of machines erected under Mr. Holden's patent (the property of this company) at the Chartered Gas Company's Beckton works.

The retort-house in which these machines were working is 360 feet long, and contains 270 circular retorts, 18 inches in diameter, and 22 feet in length, including the mouthpieces, or 540 mouths, carbonizing from 270 to 290 tons of coal per day of 24 hours.

The machines were working in the third section of the retort-house 240 to 340 feet from the stationary engine by which the endless wire rope actuating the same derives its power.

During many weeks these machines charged and discharged the 54 retorts placed at our disposal at a rate which incontestably proved their capability to do the whole work of the retort-house within the 24 hours, upon which point Mr. Trewby, the manager of those works, has repeatedly expressed himself satisfied; indeed, they frequently charged and discharged the 54 *retorts*, 108 *mouthpieces* (being a fifth of the house), in *from 50 to 55 minutes*.

It should be mentioned that even this rate of work was effected under considerable disadvantages, viz :—

1. These machines, being the first made under this patent, were manufactured on the same patterns, and the rakes of the one are opposite the scoops of the other, thereby causing a loss of time in adjusting the machines so as to bring the scoops or rakes opposite each other, and preventing them from charging and discharging simultaneously.

2. That the other two sections of the retort-house, intervening between the stationary engine and the machines, were being worked by hand labour, the mixing up of which with machine stoking was very disadvantageous to the latter, owing to the coal deposited on the floor of the house for the former being in the way of the machines and of the wire ropes driving the same.

3 That the work would be more rapidly and better done if the machines were continuously working throughout the whole retort-house, than merely operating for one hour at a time upon a small number of retorts, as all the arrangements throughout the house could then be adapted to suit the machinery. In such case, however, it would be necessary, as in the case of all machinery which has to work continuously night and day, to have duplicats machines.

Under these circumstances, I do not think the patentee unreasonable in assuming that even the above-mentioned rate of somewhat under one minute a retort will be considerably accelerated when the scoops are filled, as he has always proposed, by shoots instead of hand labour, and the machines made a pair, so as to enable them to charge and discharge simultaneously, thus operating upon *six* retorts instead of *three* at each stroke of each of the machines.

It is impossible to ascertain the point with accuracy without a complete course of experiments with separate meters, but I believe it will be found that, in consequence of the greater rapidity with which the charging and discharging of the retorts is effected by the machines, the make of gas must be increased, as the retort doors are not open so long; consequently, they are in operation for a longer period, there is less loss of gas, and the heats are not so much lowered as when hand labour is employed.

I have carefully estimated the saving that would be effected by the use of the machines, with the following result—viz., that two machines would require 18 hands to work them night and day (two shifts), and would accomplish the whole work of the retort-house, now requiring 72 men (24 scoop drivers and 48 stokers), and some of the men on the machines need be only ordinary labourers. This is exclusive of the "pipe jumpers," or "auger men," and the firemen and fire-rakers who attend to the furnaces below the stage, which will be equally requisite either by machine or hand labour; neither have I included the men required to fill the scoops, as the number of these depends upon whether this is done by hand labour or from shoots, as provided for in the specification of the patent; but, even in the former case, only eight more men (making 26 altogether) will be required. Nor, on the other hand, have I said anything of the coal trimmers at present employed with hand labour.

It is obvious from the foregoing that when the speed is accelerated and all the arrangements adapted for machine work, a pair of these machines would, at a very trifling additional expense, do the work of a retort-house containing 600 mouths, instead of 540, as in the one in question, thereby effecting a considerable further saving. In the case also of those companies who use large oval retorts taking charges of 3½ cwt., the mechanical stoking will, of course, bear even more favourable comparison to the cost of hand labour, as there will only be the small extra expense for placing the coal in the scoops.

Although these machines can, in order to suit present retort settings, be arranged to work with one, two, or three scoops or rakes at a time, still, to reap the *full* benefit of their operation, the retort settings ought to be set in threes, thus—$\frac{O}{O}$ O, but it must be remembered that this is only one of the patents belonging to the Steam Stoker Company, whose object is to perfect the system of mechanical stoking, in effecting which most desirable end they invite the cordial co-operation of gas companies, who are so largely interested in the solution of this important problem.

The Somerville and Robinson machine, illustrated in your number of Jan. 28 last, and so fully described in the paper read before the Society of Engineers, can be adapted to almost any retort-houses *without* alteration of their existing settings, and is certainly better adapted than the original Best and Holden machines or the above for small works.

Steam Stoker Company, Limited, WM. GIBSON, Secretary.
155, *Fenchurch Street, London, May* 29, 1873.

SIR,—Would you kindly allow me to correct an error which Mr. Somerville (no doubt unintentionally) made in his very interesting paper on "Charging and Drawing Gas-Retorts by Machinery," which he read before the Society of Engineers, London, on the 5th inst., and is fully reported in your JOURNAL of the 20th inst.?

In speaking of a steam stoker I invented in 1860, he states, "It was found, however, that this arrangement would not answer, and it never got beyond the provisional specification, and like the previous invention was abandoned."

Mr. Somerville is wrong in this. I not only lodged my final specification, but obtained the Great Seal; and from trials made at Bolton, in 1860, with a machine erected temporarily, it was found to answer admirably; but the gas stokers being in those days much less trouble than now (I was 10 or 12 years too advanced), it was received coldly. I, therefore, after having spent a great amount of time and money upon it, abandoned it, and consequently did not pay the third year's fee.

Gas-Works, Preston, May 30, 1873. HENRY GREEN.

SIGNAL LIGHT AT THE HOUSES OF PARLIAMENT.

SIR,—In the article which appears under the above heading in your issue of the 20th inst., I observe that when describing the gas signal light, you say of that light, "Now, however, replaced by Grammes magneto-electric light." In making this statement you have inadvertently fallen into an error, for the magneto-electric light has not replaced the gas light, but it has merely been fixed alongside of it for comparative trial. The result of the trials which have been and are still being made by Government, may not be made known for some time.

Your kindly allowing this communication to appear in the next number o your publication will oblige.

Great Winchester Street Buildings, JOHN R. WIGHAM.
Old Broad Street, London, E.C., May 31, 1873.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, MAY 19, 1873.

Sutton Southcoates and Drypool Gas Bill reported, with amendments.

Swansea Corporation Water, Bournemouth Gas and Water, and Belfast Gas Bills, read a second time, and committed.

Grand Junction Water-Works, Crystal Palace District Gas (with amendment), and Bristol United Gaslight Company's (with amendments) Bill, read the third time, and passed.

Burley Local Board Bill returned from Commons, with amendments agreed to.

POLLUTION OF RIVERS BILL.—Petition in favour of, by Teign Board of Conservators; petition against, by the Alkali Manufacturers Association.

WREXHAM AND EAST DENBIGHSHIRE WATER BILL.—Order referring this bill to a Select Committee discharged.

TUESDAY, MAY 20.

PARTICK, HILLHEAD, AND MARYHILL GAS.—A petition against this bill deposited by J. Blackley.

GASLIGHT AND COKE COMPANY.—Lord Redesdale gave notice that on Friday next he would move that Standing Order No. 179, sec. 1, be considered on Friday next, in order to its being dispensed with in respect of a petition of the Vestry of St. George, Hanover Square, praying to be heard by counsel against this bill.

STOCKTON-ON-TEES GAS.—This bill was read the third time, with amendments, passed, and sent to the Commons.

Dewsbury and Batley Corporations Gas Bill brought from Commons, and read a first time.

Gas and Water Provisional Orders Bill returned from Commons, with amendment agreed to.

POLLUTION OF RIVERS BILL.—The Select Committee on this bill was appointed, consisting of the Lord Privy Seal, Duke of Northumberland, Marquis of Salisbury, Earls Doncaster, Lauderdale, and Morley, and Lords Portman, Vivian, Aveland, and Penrhyn.

FRIDAY, MAY 23.

BARROW-IN-FURNESS CORPORATION.—Petitions against this bill were presented, by the Ulverston Water Company; J. Bintley; R. Hannay; and others.

Swansea Corporation Water Bill reported, without amendment.

Bournemouth Gas and Water Bill reported, with amendments.

Partick, Hillhead, and Maryhill Gas Bill read a second time, and committed.

Scarborough Gas, Harrow Gas, and Sutton Southcoates and Drypool Gas (with amendments) Bills, read third time, and passed.

GASLIGHT AND COKE COMPANY'S BILL.—On the motion of Lord Redesdale, it was resolved that Standing Order No. 179, sec. 1, be dispensed with in respect of a petition of the Vestry of St. George, Hanover Square, praying to be heard against the bill. Petition presented, read, and ordered to lie on the table.

Gas and Water Provisional Orders Confirmation (No. 2) Bill brought from Commons, and read first time.

Bristol United Gaslight Company, Buxton Local Board, Pontypool Gas and Water, and Crystal Palace District Gas Bills, returned from Commons, with amendments agreed to.

POLLUTION OF RIVERS BILL.—Petition presented in favour thereof by the Board of Conservators for the Carnarvon Salmon Fishery District.

MONDAY, MAY 26.

DEWSBURY AND BATLEY CORPORATIONS GAS BILL.—The certificate of the examiners that the further Standing Orders applicable to this bill had not been complied with presented, and ordered to lie on the table. Bill, together with the certificate, referred to Standing Orders Committee on Thursday, June 12.

The following bills received the Royal Assent by commission:—

Gas and Water Provisional Orders Confirmation.
Glasgow Corporation Water.
Grand Junction Water-Works.
Burley Local Board.
Scarborough Gas.
Buxton Local Board.
Pontypool Gas and Water.
Bristol United Gaslight Compy.
Crystal Palace District Gas.

Gosport Gas Bill reported, with amendments.

Barrow-in-Furness Corporation Bill read second time, and committed.

GAS AND WATER PROVISIONAL ORDERS CONFIRMATION (No. 2) BILL.—Ordered to be read second time on Monday, June 9.

PARTICK, HILLHEAD, AND MARYHILL GAS BILL.—Petition of Messrs. Grahame and Wardlaw (parliamentary agents) presented, praying leave to present a petition by W. S. S. Craufurd to be heard against the bill, although the time limited by Standing Order No. 179, sec. 1, for presenting such petition has expired. Ordered to lie on the table, and the Standing Order to be considered to-morrow, with a view to its being dispensed with in respect of the said petition.

TUESDAY, MAY 27.

DEWSBURY AND BATLEY CORPORATIONS BILL.—Petition against deposited by B. Sheard and others.

Belfast Gas Bill reported, with amendments.

Swansea Corporation Water Bill read third time, and passed.

Bournemouth Gas and Water Bill read third time, with amendments, passed, and sent to Commons.

PARTICK, HILLHEAD, AND MARYHILL GAS BILL.—Standing Order No. 179, sec. 1, considered and dispensed with in respect of a petition of W. S. S. Craufurd, praying to be heard against the bill. Leave given as prayed.

Atherton Local Board and Lincoln Gas Bills brought from Commons, read first time, and referred to examiners.

Stockton-on-Tees Gas Bill returned from Commons, with the amendments agreed to.

POLLUTION OF RIVERS BILL.—Petition in favour of, by Wakefield Water-Works Company, read, and referred to Select Committee. Ordered that the evidence taken before the committee be printed for the use of members of the House, but no copies to be delivered, except to members of the committee, until further orders.

HOUSE OF COMMONS.

MONDAY, MAY 19.

Dewsbury and Batley Corporations Gas Bill read third time, and passed.

GAS COMPANIES.—Petition presented from the Fareham Gas and Coke Company for inquiry; to lie on the table.

Gas and Water Provisional Orders Confirmation (No. 2) Bill considered in committee, and reported.

NOXIOUS BUSINESSES.—On the motion of the Home Secretary, the following members were named a Select Committee appointed to consider the operation of clause 55 and 56 of Act 7 & 8 Vict., cap. 84, and the best means of making provision concerning the offensive or noxious businesses therein specified:—Mr. Headlam, Sir C. Adderley, Messrs. Torrens, W. H. Smith, Morley, Lord G. Hamilton, Dr. Brewer, Mr. E. Turnor, Sir J. Ogilvy, Mr. Davenport, Mr. Locke, Sir C. Mills, Messrs. Samuda, F. Walpole, and M. Guest.

Ayr Burgh Bill reported.

GAS AND WATER PROVISIONAL ORDERS BILL.—Lords amendment considered and agreed to.

TUESDAY, MAY 20.

Glasgow Corporation, and Uxbridge and Hillingdon Gas Bills, reported.

WEDNESDAY, MAY 21.

Gas and Water Provisional Orders Confirmation (No. 2) Bill, as amended, considered; to be read third time to-morrow.

THURSDAY, MAY 22.

THE CHARTERED GAS COMPANY.

Sir CHARLES DILKE asked the President of the Board of Trade if Mr. Reilly, the legal commissioner appointed by the Board of Trade to report upon the increased price for gas demanded by the Chartered Gas Company, had been in several preceding sessions parliamentary draughtsman and counsel to the Chartered and other metropolitan gas companies; and whether it was the intention of the commissioners that the Western Gaslight Company, Limited, should increase the price of cannel gas from 5s. to 6s. 3d. per 1000 feet, whilst the company only claimed from the consumer 5s. 5d. so recently as the 4th of April last, that company having only recently been amalgamated with the Chartered Gas Company, and having handed over a large reserve-fund to meet the increase in the cost of material and wages.

Mr. CHICHESTER FORTESCUE: The hon. baronet has asked me two questions. The second question is, of course, unobjectionable; but with regard to the first, I regret that the hon. gentleman has thought it right to ask it. He asks me if Mr. Reilly, the legal commissioner appointed by the Board of Trade to report upon the increased price for gas demanded by the Chartered Gas Company, had been in several preceding sessions parliamentary draughtsman and counsel to the Chartered and other metropolitan gas companies. Of course that question means to impugn the impartiality of the legal commissioner appointed by the Board of Trade to conduct the recent inquiry. I can only say that Mr. Reilly is very well known, and his character stands so high—(cheers)—that it is quite unnecessary for me to defend it in this House. I have not inquired whether he had been employed by the London Chartered Gas Company or not. Very probably he was, just as he had been employed by the Corporation of the City of London and by the Metropolitan Board of Works, who were the opponents of the gas companies, and by Her Majesty's Government. I can only say, that in the opinion of all parties the recent inquiry was admirably well conducted. With regard to the second part of the question, the Western Gas Company now forms a part of the Chartered Gas Company, and the revised price applies to the whole undertaking of the united companies. The hon. baronet is mistaken in supposing that the Western Gas Company only were to increase the price of their gas; the facts are, that the Western Gas Company now forms part of the Chartered Gas Company, and the revised price was fixed by the commissioners. The Western Gas Company could not have charged more if it had remained still in existence, but having united itself with the Chartered Gas Company, the price of the united companies was in April last 5s. 5d., and until the inquiry of the commissioners had taken place that price could not be exceeded. With regard to the reserve-fund, which the question implies was handed over by the Western Gas Company to the Chartered Gas Company, it was proved before the commissioners that the reserve-fund had been applied in the year 1872 for the purpose of making up the dividend of the year. It is not available for the current year, and the question which the commissioners had to settle was the price of gas for the year 1873, which, by the Act of 1868, they were bound to fix at such a sum as with ordinary care and management on the part of the company was calculated to yield them a dividend of as near as may be, but not exceeding 10 per cent.

BUXTON LOCAL BOARD AND PONTYPOOL GAS AND WATER BILLS.—Lords amendments agreed to.

Atherton Local Board Bill, as amended, considered; to be read third time.

GAS COMPANIES.—Petitions for a Select Committee of inquiry into the effect of recent legislation, presented from Lowestoft Water, Gas, and Market Company; and Thirsk Gaslight and Coke Company.

Gas and Water Provisional Orders Confirmation (No. 2) Bill read third time, and passed.

FRIDAY, MAY 23.

COLNE VALLEY WATER BILL.—Petitions in favour of this bill were presented by the Harrow-on-the-Hill Local Board of Health, and owners, &c., of Bushey, and other places.

BRISTOL UNITED GAS AND CRYSTAL PALACE DISTRICT GAS BILLS.—Lords amendments agreed to.

Lincoln Gas Bill read third time, and passed.

MONDAY, MAY 26.

Atherton Local Board Bill read third time, and passed.

Ayr Burgh Bill, as amended, considered; amendments made; bill to be read third time.

Glasgow Corporation Gas Bill, as amended, considered; amendment made; bill to be read third time.

Newcastle-upon-Tyne and Gateshead Gas Bill, as amended, considered; amendment made; to be read third time.

Uxbridge and Hillingdon Gas Bill, as amended, considered; to be read third time.

Portsmouth Borough Water Bill read second time, and committed.

Colne Valley Water Bill (Lords) reported; report to lie on the table.

MIDLOTHIAN WATER AND BRITON FERRY LOCAL BOARD BILLS (LORDS).—Report that Standing Orders had been complied with; bills to be read second time.

TUESDAY, MAY 27.

STOCKTON-ON-TEES GAS BILL.—Lords amendments agreed to.

Over Darwen Local Board of Health Bill, as amended, considered; bill to be read third time.

MIDLOTHIAN WATER BILL.—Petitions deposited, praying to be heard against, by Earl of Wemyss and March; Provost, Magistrates, and Town Council of Peebles; John M. Baillie (as *curator bonis* to Alexander Horsbrugh), and Edinburgh and District Water Trustees.

HOUSE OF COMMONS.

THURSDAY, MAY 1.

(*Before Admiral* ERSKINE, *Chairman; Mr.* FLETCHER, *Sir Wm.* RUSSELL *and Colonel* CARINGTON—*Mr.* BONHAM-CARTER *sitting as Referee.*)

BARROW-IN-FURNESS CORPORATION IMPROVEMENT BILL.

Mr. PRICE, Q.C., Serjeant SARGOOD, and Mr. LASCELLES appeared for the promoters; Mr. DENISON, Q.C., and Mr. SALISBURY appeared for the Ulverstone Water-Works Company, who opposed the bill, and for Mr. Job Bintley, the owner of a mill on Pennington Beck, from which the supply of water for Barrow was proposed to be taken. Mr. LITTLER, Q.C., and Mr. YORKE appeared on behalf of Mr. Hannay; Mr. MICHAEL and Mr. THESIGER for Mr. Fell; and Mr. PEMBER represented Mr. Sunderland; all of whom were riparian proprietors.

Mr. PRICE, Q.C., in opening the case for the promoters, said the objects of the bill were threefold—for the construction of additional water-works, for new gas-works, and for street improvements. The only opposition given was to the powers sought by the corporation for additional water-works. Barrow-in-Furness was situated on a kind of promontory, which abutted on the sea shore. With the exception of the town of Middlesborough, in the North

Riding of Yorkshire, it was the most remarkable instance of the increase of population and of the wonderful development of resources and of wealth. As in the case of Middlesborough, this was entirely owing to the great mineral resources of the district in which Barrow-in-Furness was situated. In 1842 Barrow contained only some 12 or 13 houses, with a population of about 100. At the present time it had a population of 30,000. The resources of the district began to be developed after the formation of a railway, called the Furness Railway, which was opened in 1844, and in connexion with it, though not forming part of the scheme, the Lancaster and Ulverstone Railways were also brought into operation. By these means, as also by the amalgamation afterwards with another company, Barrow was connected with the whole of the railway system of England and Scotland. At that time the idea of making Barrow a seaport had not fully developed itself, but it had now a very large and increasing traffic in the way of shipping. Five docks had been built, and contiguous to them there were large manufactories of steel and iron. The first works established there in 1859 were the iron-works which were owned by Messrs. Schneider and Hannay, who were also the proprietors of the Barrow Hematite Company, but which was now merged into a company called the Barrow Hematite Steel and Iron Company. Such a concern as this required an immense supply of water, which hitherto had been very deficient. In 1864 the population was 7500. Great inconvenience was found at that time from want of water, and in consequence of that the railway company constructed small reservoirs at a place called Irleth, about eight miles from Barrow, principally with a view to the convenience of their own works. They also, to some extent, supplied water to other persons. At the same time Messrs. Schneider and Hannay constructed a reservoir near the iron-works, called the New Barns reservoir. The supply of water having been still deficient, a gas and water company was established in Barrow. In 1864 they constructed certain works at a place called Poaka Beck reservoir. The drainage area of the Poaka Beck reservoir was 692 acres. That company in 1864 took powers to utilize the pipes and reservoir of the railway company, which had enabled them to supply the town of Barrow up to the present time. The cost of these works of the railway company was £14,250, and the new works under the Act of 1864 cost about £15,750. In 1866 these works were opened. In 1867 a charter of incorporation was granted to the borough, and in 1868 an Act was passed enabling the corporation to purchase the gas and water company's works. That transaction was carried through by the energy of Sir James Ramsden, the first mayor of Barrow, who would be a prominent witness. The Poaka Beck reservoir had a capacity for 160 millions of gallons. Previous to the incorporation in 1868 of the gas and water company, the steel-works company had agreed to take all their water from them, and to do their best to prevent anybody else coming and interfering with the operations of the gas and water company of Barrow. That being so, in 1871 the steel-works company constructed a reservoir with a storeage capacity of 60 million gallons, which stored the flood water of the Poaka Beck. The Poaka Beck reservoir yielded 1¼ million gallons per day. The aggregate storeage capacity of the corporation reservoir was 176 million gallons, and there were other reservoirs, belonging to a slate company, which would give a storeage capacity of 60 millions, making a total storeage capacity of 236 million gallons—equal to 190 days consumption. In 1864 there were 7000 inhabitants, and 115,000 gallons a day were required, at the rate of 16½ gallons per head. In 1872 the population was 30,000, with a consumption for trade and domestic purposes of 1,124,000 gallons per day, or at the rate of 37½ gallons per head. The present demand was quite equal to the supply, and it would be necessary to have an enlarged supply to meet the future wants of the town, which from its situation and undeveloped resources was steadily and largely increasing. The proposed reservoir was intended to store the water obtained from a drainage area of 1139 acres of a stream called Pennington Beck. The ground on which the proposed reservoir was to be constructed was purchased some time ago by Sir James Ramsden, who had always been very attentive to the wants of the district. The capacity of the proposed reservoir was 140 million gallons per day, and being on the same level as the Poaka Beck now was, it was proposed to connect the two reservoirs by an aqueduct, and it was a matter of considerable importance that the existing pipes, conveying water from the Poaka Beck reservoir, would, without incurring any additional expense, be further utilized in bringing down the additional water to Barrow. In fact, the proposed gravitation scheme was one by which the inhabitants of Barrow would get the maximum amount of water at the minimum rate of expense, which was a very important element, considering the water had to be paid by rates levied by the authority of the corporation. The estimated cost of the works proposed by the bill was £28,000, and the time for completing the works was expected to be two years and a half. The opposition to the bill was of two kinds—that of the Ulverstone Water-Works, and of the riparian proprietors. Ulverstone was a town of about 9000 inhabitants, but was by no means an increasing place. The Ulverstone Water-Works Company obtained powers in 1852 to construct works in the district which the present bill sought to tap. They had allowed their powers to expire, they had constructed no reservoir, and had practically done nothing except to impound the water at a place called Pennington Mill. They had used the mill dam as a reservoir, which they had found quite sufficient for all the purposes of Ulverstone and district from 1852 to 1872. That being so, it would be a hard case if the promoters of this bill were restricted from obtaining powers to supply the important town of Barrow from the source now sought. The Ulverstone Water Company had powor to take 600,000 gallons from the Pennington Beck. They had a capital of £8000, with a borrowing power to the extent of £2600, both of which powers they had never used. Besides, they had only been taking 200,000 gallons a day from the Pennington Beck instead of 600,000. A meeting took place in February, 1873, after the plans and notices of the present bill had been deposited, between the Local Board of Ulverstone and a deputation from the Corporation of Barrow, at which an agreement was come to that the Barrow Corporation would, in the event of the present bill being passed, guarantee to the town and district of Ulverstone 400,000 gallons of water per day free of charge, if required, and that they would have a further supply of 200,000 gallons per day at a small cost should they, at any future time, require it. There was another petition against the bill by a Mr. Bintley, the owner of Low Mill, situated on Pennington Beck. It appeared, however, that this mill, having been for sale, Mr. Bintley purchased it after the introduction of this bill, thinking to use it as a lever for the purpose of opposition. This of itself should form a strong reason for disposing of his opposition. He (Mr. Bintley) alleged that his mill would be very much injured by the passing of this bill, but it appeared that the mill was in a very shaky and ricketty condition, and had not the appearance of remaining long above ground. Mr. Bintley suggested in his petition that there were other and better sources of supply than that which the present bill proposed, and pointed to a stream or brook called the Lickle Duddon, as better source of supply. He would only tell the committe that this suggested scheme would compel them to go about 15 miles away from Barrow, and that there would be an expenditure of £64,000 for mains, and about £20,000 for reservoir, in fact, there would be a smaller supply of water at an increased cost of £56,000. It was to be hoped that this, coupled with Mr. Bintley's recent purchase of the mill, would be sufficient reason to reject Mr. Bintley's petition. There were other petitions from riparian owners, who all alleged that the beauty of their residences would be marred and the amenities of the property would be destroyed by the Beck being dried up. This could never be the case, as the Ulverstone Water Company had been taking the water from Pennington Mill Dam, which was to a great extent dependent on the drainage of the comparatively small piece of ground on which the properties mentioned were situated. If the corporation succeeded in passing their bill, that particular portion of the district would be entirely free from the operation of any storeage or impounding whatever, because the mains and pipes would go direct from the proposed reservoir into the town of Ulverstone. There would not be the slightest suction, therefore, from that portion of the district which now fed Pennington Mill Dam, which now abstracted so much of the water that came down Pennington Beck past these gentlemen's houses. There were 16 petitions from riparian owners, 12 of whom appeared on their own petition and four were represented by counsel. He (Mr. Price) submitted they had no case. He believed that after the passing of the bill they would be in no worse position than they were now. There was still the question to be raised before the committee, whether these gentlemen could not, in point of fact, be sufficiently compensated for their individual injury, considering the amount of public good which the Corporation of Barrow sought to effect by this bill.

The first witness called was

Lord *Frederick Cavendish*, examined by Mr. LASCELLES.

I am chairman of the School Board at Barrow. I am also chairman of the Barrow Hematite Steel and Iron Company. I am well acquainted with the district around Barrow-in-Furness. Of late years the increase of population has been very marked. In 1861 the population was between 4000 and 5000. The last census it was between 18,000 and 19,000. At present its population would be about 35,000. In 1867 the town was incorporated, and in the following year they obtained powers for the purchase of the gas and water works. At present the water supply is almost sufficient; but as time goes on, and Barrow increases, it will be totally insufficient. I think it very desirable therefore, in the interests of the town, that there should be a better water supply.

Cross-examined by Mr. SALISBURY: I have not read the bills. I know the promoters are going into a district over which the Ulverstone Water-Works Company have certain rights, for the purpose of getting and supplying water. The corporation propose to give the local board of Ulverstone 600,000 gallons of water per day gratis, and 200,000 if required at a very small cost. Our object in coming before the committee is to say this—that Barrow having increased so rapidly as to population, they want more water for themselves.

Sir *James Ramsden*, examined by Mr. PRICE.

I was the first mayor of Barrow, and held that office for five or six years until November last. I am also high sheriff of the county of Lancaster. I have been intimately acquainted with Barrow from its infancy—for a period of over 25 years. In that time it has grown up from a hamlet of 12 or 13 houses to a town of 30,000 inhabitants. There can be no doubt but that it will continue to advance. The only thing which prevents it advancing more than it is doing at present is want of house accommodation. At present there are various works requiring from 2000 to 3000 additional workmen, and these cannot be obtained for want of building accommodation.

Mr. PRICE: What are the great works now in operation there?

Witness: The Steel and Iron Works, the Jute Works, and the Barrow Shipbuilding Works. There are also steel wire works, several large foundries and engine works. There is also a very large timber trade. The mineral resources of the district are almost unlimited. They afford a very large supply of hematite. Large docks have been constructed there of late years. There is a very large shipping trade, which is due to the trade of the district and the increased accommodation given to a large class of vessels. There are at present two docks, each covering a space of 35 acres; and an additional dock is being constructed which will be about 200 acres in extent, and contracts are now being made with various shipping companies for the use of the new dock when it is completed. The importation of timber is very large. Last year there were 80 vessels for one firm alone, Price, Potter, and Co. When the line was constructed, Ulverstone was the capital of the district. The line was first constructed from Dalton to Barrow, and from Irleth to Barrow on account of the slate works. Dalton is also a very increasing district. It is in the centre of the mining population. There are large collieries at Askham and Hawcoat; and the land to the north of Hawcoat is about to be laid out for business purposes. I have not the slightest doubt that sites in that district will be required for various purposes. Up to the present time we have been obliged to discourage people who desired to settle, on account of the want of house accommodation, which is really the only drawback. If houses could be built to-morrow for 60,000, there would be found people to fill them. The population of Dalton, including Askham, is 12,000. After the railway was constructed arrangements were made from time to time with other companies by which Barrow was put into communication with the whole railway system of England and Scotland. The district at present is partly supplied from the Poaka Beck, and the rest of it by wells. This supply very soon failed, because directly the railway was opened the necessities of the railway required it. In 1858 the railway company continued their pipes to Irleth, and arranged for the Irleth reservoir, and there impounded the water of the Poaka Beck. It was no sooner completed than it was found to be too small for the purposes of the population and the works, and then a limited liability company was started, and the pipes of the railway company became the property of this new company. It was a registered company. In 1864 there was a company called the Furness Gas and Water Company, empowered under an Act of Parliament. Under the Act of 1864, for the further extension of the works to meet the growing requirements of the place, the reservoir at Poaka Beck was then constructed. It has a drainage area of 692 acres, which is the extent of the area from which we now get the supply. At that time the railway works were absorbed or utilized by the gas and water company. They are now the property of the corporation. The mains originally constructed by the railway company are still utilized. £14,250 has been spent by the railway company; the addition to the works under the Act of 1864 cost over £15,000. In 1866 these works were opened. In 1867 we got a charter to incorporate the borough. After that was granted arrangements were made for the corporation taking over the gas and water property. The corporation at present have the whole control of the supply of gas and water. The population between 1867 and 1873 has been nearly doubled. I have no doubt if this bill is granted in the present session of Parliament that by the time the works are completed a great additional quantity of water must be required by the increased population. The ground, part of which will be utilized for the reservoir, was purchased by myself when it was in the market. Seeing the wants of the district, I knew that some day it would have to be utilized for the purposes proposed. The district around Poaka Beck reservoir is the nearest and cheapest drainage area to which we could have recourse for a supply. The Ulverstone Water-Works Company got their Act in 1852—about 18 years ago, and during all that time they have almost done nothing except utilizing Pennington Mill Dam. As a member of the corporation I have had interviews and negotiations with the Local Board of Ulverstone. We made an arrangement to provide them with 400,000 gallons a day free of cost, with an addition of 200,000 a day a little over cost price, and they were quite satisfied with that. Ulverstone is an increasing place, but it is not increasing at the rate of Barrow. There are no works of any importance in it. As a member of the committee I have gone into the cost of this scheme, and have reason to believe that this is the best scheme that can be promoted.

Cross-examined by Mr. SALISBURY: I am a shareholder of the Ulverstone Water Company. When they obtained the Act of Parliament in 1852 there was some contention about it. It was then thought to be a small affair. Their capital was £8000, and they had borrowing powers to the extent of £2600, which was then thought to be sufficient for the purposes of the Ulverstone district. I believe they were at the expense of £2000 before they got the Act passed, on account of opposition they received from the canal com-

pany and the railway company. A clause was inserted in the bill binding them to supply the canal company with 200,000 gallons daily, at a price to be agreed upon. The railway company also got a clause binding the Ulverstone Water Company to supply to them 20,000 gallons per day, at £20 per annum. That power is still in existence, I believe.

Mr. SALISBURY: You say you bought the ground on part of which the reservoir is proposed to be built. Did you ever suggest to yourself the propriety of going to this district until this estate was for sale?

Witness: Yes. It has been in the minds of the engineer. I purchased the land from a Mr. Rawlins for myself. I paid £4000 for it. If this bill passed I was to hand it over to the corporation at the sum I paid for it. There was no profit to be made out of it. The corporation decided on this scheme in the autumn of last year after I had purchased this land. The corporation knew that Ulverstone was imperfectly supplied with water, and they were to extend their works to Ulverstone, and they entered into an agreement with the local board to supply water at a comparatively small cost.

By Mr. MICHAEL: I know the property of Mr. Fell. It is a property immediately above the proposed reservoir. The Pennington Beck runs through part of the property. We propose now going into the watershed of another district.

Re-examined by Mr. PRICE: I do not understand you to adopt my learned friend's suggestion as to a watershed belonging to one district or another?

Witness: No.

Mr. PRICE: In reference to the agreement come to between you and the local board, what you told the committee was come to upon the supposed basis that the water-works company and the local board would come to terms?

Witness: Yes.

Mr. PRICE: And in this very agreement I am right, am I not, in saying that the last paragraph includes a proposition on your behalf on the part of the corporation to contribute the sum of £2000 for the purpose of purchasing for the local board the water-works company's pipes?

Witness: That is so.

Mr. PRICE: So that, having this in view, you are willing to subscribe £2000 if they can come to terms with the water-works company?

Witness: Yes; and at that time, as far as I know anything about it, I believed there was a prospect of that arrangement being brought about. I think it would be advantageous to the district if the supply of water was in the hands of the Local Board of Ulverstone. I have no doubt, if the local board come to terms with the water-works company, that we shall be both willing and able to give it a proper supply.

Mr. *Richard Potter*, examined by Mr. LASCELLES.

I am a partner in the firm of Price, Potter, and Co., a large firm engaged in the timber trade. We have establishments in Gloucester, Grimsby, and Barrow.

Mr. LASCELLES: What attracted you to Barrow?

Witness: Its geographical position. There is also plenty of room to carry on our trade. The timber trade is a bulky trade, and requires a great amount of space, which we can get cheaper in Barrow than we could in Liverpool. I have not known any place rise so rapidly as Barrow has done. I am chairman of the Grand Trunk Railway of Canada, and in the autumn of last year I travelled through the whole of the Northern States of America, and I do not know any place, either there or in the Western States, where the rise and progress of industry has been more rapid than in Barrow-in-Furness.

Mr. LASCELLES: What do you think of the present water supply of Barrow?

Witness: During several visits I made to the steel works last year, Mr. Smith, the manager, complained of the insufficiency of the water supply.

Mr. LASCELLES: Has the shipbuilding increased?

Witness: There is an enormous establishment there with a very large business. With reference to the house accommodation it is very insufficient. We cannot get men on our business on that account. If the population increased, the present supply of water would be insufficient.

Mr. *H. W. Schneider*, examined by Mr. LASCELLES.

I have known Barrow since the year 1838. It is largely and continually increasing. The house accommodation is very deficient. At present there is not a sufficient supply of water. Our present drainage area is about 692 acres. There is no district so subject to periodical droughts as this part of the country. The rain comes down far more rapidly in this part of the country in 24 hours than it does in any other. At my own house I have known as much as 2½ inches fall, and as the water falls with that rapidity a very large amount runs to waste, and is practically of no benefit. The streams are in consequence during a great part of the year very low. The population of Ulverstone at the last census was between 7000 and 8000. The 600,000 gallons proposed to be sent down by the corporation represents 30 gallons per head per day to a population of 20,000, which should, I think, be sufficient. The Ulverstone Water Company at the present time have no means of making any storeage whatever. They are dependent upon the Pennington Mill Dam for their daily supply of water, and there is next to no water sometimes coming down the Pennington Beck, and practically above the Pennington Mill there is no water for anybody; but by the proposed arrangement 600,000 gallons of water will be turned out of the reservoir every day, even in the driest weather, so that Ulverstone will be supplied as it never has been before. In fact, the corporation propose to give an amount of water to Ulverstone which is equal to a town two-and-a-half times its size.

Cross-examined by Mr. SALISBURY: I understand you are to make a tunnel and to take our water to the Poaka Beck reservoir, and you would divert all the water except the 600,000 gallons.

Witness: I state this in answer to your question. It is perfectly ridiculous to say that that reservoir will inflict an injury on the Ulverstone people in the slightest degree; on the contrary, I contend that to the Ulverstone people and to the riparian owners it will be a benefit, for this reason, that the 600,000 gallons will be let down free to every one.

Mr. SALISBURY: The Ulverstone Company, I believe, however, has been a bad paying concern; but the Barrow Corporation do not want to make it a worse paying concern. They are willing to give Ulverstone the water, if required. I do not know of any communication that was made to the Ulverstone Water Company by the Barrow Corporation. I was informed and believe that there were negotiations going on between the Local Board of Ulverstone and the water company for the purchase of the water-works, and we entertained a very strong opinion that the local board were the proper parties to supply the town with water. I was engaged in these negotiations. I cannot remember the date of the interview; it must have been in January or February of this year.

Mr. SALISBURY: Is it a fact that, without any communication either with the local board or the water company, you put clause 20 into your bill, which proposes to extend your water limits and to take powers to supply the town and parish of Ulverstone?

Witness: I suppose it was put in.

Mr. SALISBURY: I may take from you that you are prepared to put a clause into this bill to give the water company, as compensation, 400,000 gallons of water per day free, and 200,000 more on demand at a small price?

Witness: Yes; but we do not tie ourselves to the strict letter of the proposed agreement with the local board.

Cross-examined by Mr. MICHAEL: I know Fell Bank, the residence of Mr. Fell. It is below Pennington Mill. The Pennington Beck runs down to the mill, then enters Mr. Fell's estate for a short distance and runs on again at some considerable distance. The drainage area at present supplying Ulverstone is 1487 acres. Of this the present bill proposes to take 1130 acres, which will leave 357 acres for the company.

Mr. MICHAEL: Then how do you propose to compensate Mr. Fell for this loss? He will sustain a loss, will he not?

Witness: The riparian owners will sustain a loss, no doubt.

Mr. MICHAEL: Money compensation will not supply water. Have you even put into your bill any amount which represents the compensation you will have to give for the supply of water?

Witness: No.

Mr. MICHAEL: Then you think you can go and invade the water district of your neighbour, and take water from it without paying for it? Can you say for an instant that this watershed belongs to your district?

Witness: I do not know why it should not. Within our present watershed we cannot get sufficient water for Barrow. The water we get from the district below Dalton is so impregnated with lime that we cannot use it for any purposes. The water we propose to impound is the best that can be obtained in England, and does not contain any deleterious matter. This is the only reason why we propose to go into another district.

By Mr. YORKE: I know Mr. Hannay's property. Although the water is cut off from Pennington Beck, it would not interfere with him as far as Barn Beck is concerned, which runs into the Pennington Beck below the mill.

Mr. PRICE: Mr. Hannay says it is a beautiful trout stream.

Witness: I should say that a man who went to catch trout would be very idle, because he would have to work six days before he caught one.

Mr. PRICE: The water-works company now impound at Pennington Mill. In future, the portion of 357 acres left will be entirely free, and therefore water will go to the riparian owners in larger quantities than it does now.

Witness: Yes; that would be so.

Mr. *Joseph Smith*, examined by Mr. LASCELLES.

I am mayor of the borough of Barrow. I am also manager of the works of the Barrow Hematite Company. We employ nearly 4000 men. At a very early period after we started we were necessitated to make a reservoir at New Barns, which supplied us for two or three years. In 1866 the Furness Railway Company constructed two small reservoirs for their works above Irleth. In 1864 the larger reservoir was made at Poaka Beck, and in 1868 the whole of the reservoirs were taken by the Barrow Corporation, which has now the entire power of supplying the water of the borough. The town is steadily increasing. It is badly off for water as to situation. We have to depend upon having our supply from the Poaka Beck reservoir.

The CHAIRMAN stated that the committee had had sufficient evidence as to the want of a proper supply of water, and also as to the future increase of Barrow.

Cross-examined by Mr. MICHAEL: The quantity at present supplied to Barrow is 30 gallons per head per day. We supply the steel works at 6d. per 1000 gallons, and we have an ascending scale up to 1s. 6d. It is all measured by meter. We have a compulsory water rate. I am not acquainted with Mr. Fell's estate.

Mr. *Wadham*, examined by Mr. PRICE.

I am resident agent for the Duke of Buccleuch, and have been so for upwards of 20 years. The insufficiency of the water supply was brought to my notice in my capacity as chairman of the Health Committee, as it would be necessary to use sea water for the watering of the streets. The inspector of the Local Government Board personally impressed upon me the necessity for a supply of water with the least possible delay on sanitary grounds.

Cross-examined by Mr. THESIGER: We have not made any attempt to add to the capacities of our present reservoirs.

Mr. *Frank C. Stileman*, examined by Mr. Price.

I am a civil engineer, carrying on business at Great George Street, Westminster. I have been engineer-in-chief for the Furness Railway from its commencement to the present time. At first the railway company got their supply from wells by pumping the water into tanks. After that we pumped out of the main stream about a mile and a half from Barrow. In 1864 we then constructed a reservoir at Irleth. In the same year an Act was passed empowering the company to form the Poaka Beck reservoir, and to supply Barrow with water. In 1868 the Barrow Corporation Act conferred all these powers on the corporation, and they have a duplicate main-pipe between Poaka Beck and Barrow, which now forms the system of the Barrow Corporation Water-Works. The reservoir at New Barns was purchased by the Water-Works Company in 1865 from Messrs. Schneider and Hannay, and now forms the low-service supply of Barrow. The Poaka Beck reservoir is 500 feet above the sea level, and the New Barns is about 100. At present the demand for water is quite equal to the supply, and there is the prospect of a greater demand as we go on. The point from which we now propose to take water had been recommended by me many years ago. Although the Ulverstone Water Company had powers under their Act to construct works there, they had never done so. All they had done was to utilize the Pennington Mill Dam, and to conduct the water from thence by pipes to Ulverstone. The capacity of the mill dam is about 80,000 gallons. The Ulverstone Water-Works Company's Act expired 18 years ago. To go to Lickle Duddon, as suggested in Mr. Bintley's petition, would involve a further outlay of 16 miles of absolutely new pipe. I have examined the place since the two petitions were lodged. We might get the same amount of water from the Lickle as we would get from the proposed area, but the difference of cost would be about £60,000. It would also increase the rates at Barrow, as additional interest on the money would have to be paid. It would also take a year longer to get the works completed. There are also millowners on the Lickle, who would have to be compensated, or dealt with in some way. By our proposed scheme there would be no difficulty in connecting the proposed reservoir with the Poaka Beck reservoir. Then there would be an advantage by our utilizing our existing pipes in bringing the additional supply to Barrow. No additional outlay would be required for mains. There would be no difficulty in giving Ulverstone 600,000 gallons. I have always looked upon the scheme as simply a scheme of the district, taking Ulverstone as part of the area to be supplied from that district.

Mr. PRICE: What effect would that have with regard to the supply of water to the town of Ulverstone? Would it be more certain than it is now?

Witness: As now proposed by the Barrow Corporation, it practically puts the town of Ulverstone in the same position as it would have been if, under the Act of 1852, they had constructed the whole of their works.

Mr. PRICE: Having in view the increase of Ulverstone, would the supply you now propose to give them be sufficient?

Witness: I have known it since 1844. It is not so happily situated as regards district as Barrow. Its population has only increased 415 within the last ten years. There are no works of any importance being erected in the neighbourhood.

Mr. PRICE: What would be the relief given to the riparian owners supposing the water was taken from the millstream, and brought to Ulverstone by pipes?

Witness: The riparian owners in my view will be benefited to the extent of a rainfall of 400 acres. The position of affairs is practically this: the Pennington stream is now tapped at Pennington Mill, and it will now be taken to where the proposed reservoir is, and the riparian owners will have the advantage of the rain that falls on the portion at present used, so that they will be in a better position then than they are now. If the Ulverstone Water Company or the local board accept the compensation that is made to them to take their supply of water from the proposed reservoir, the increase of drainage area from the proposed reservoir to the Pennington Mill would be for the use of the riparian owners. That supply would be all in addition to what they would get at the

present time. There is another beck running into the Pennington stream below the mill, which would feed it, and which would be quite untouched. Our present reservoir has a capacity of 236 million gallons. From the new area we would get 140 million gallons additional. The present supply for Barrow is 1,260,000 gallons per day for a population of 42,000, or 29 gallons per head per diem. The new scheme will double our present supply. It will give 58 gallons per head upon the present population. Mr. Bintley's premises were once used as a cotton mill, but they have been for a great number of years a ruin. They are now used for brush and bobbin making. Mr. Bintley became the owner of them since this bill has been deposited. Mr. Bintley is the engineer of the Ulverstone Water-Works.

Cross-examined by Mr. SALISBURY: Do you know that this dilapidated property brings £100 a year rent?

Witness: It may be worth that.

Mr. SALISBURY: It would surprise you very much, would it not, to hear that this Lickle Duddon scheme might be constructed by a competent man for some £22,000 or £23,000?

Witness: I do not believe that.

The REFEREE said as this was not an alternative scheme, the question of cost, &c., could not be gone into. It was open to the petitioners to show that the scheme proposed by the promoters was a bad one, but to go into the question of the cost of an alternative scheme was going quite beyond the limits of their petition.

After some consultation, the CHAIRMAN said that the committee declined to hear the question of the estimate and costs of the Lickle Duddon scheme.

FRIDAY, MAY 2.

Mr. *F. C. Stileman* was recalled, and further cross-examined by Mr. DENISON.

Mr. DENISON: Inasmuch as we have already paid for 600,000 gallons, how can you ask us to pay 4d. per thousand for a third of that quantity?

Witness: Simply because you have failed to spend the money to obtain 600,000 gallons. You have no reservoir to secure for yourselves 600,000 gallons a day from Pennington Beck, and your proposed pipes at present can take only about 300,000 gallons per day. The whole of the 600,000 gallons flow past you in dry weather. You would require a much larger reservoir; but if we supply you with 600,000 gallons you will be avoided the necessity of making any reservoir whatever, and you will have a constant supply. In dry weather the Pennington Beck can only supply under 300,000 gallons. I have known the district since 1844, and I have sometimes known the Pennington Beck to be absolutely dry. The cost of our tunnel will be £10,600. It is to go through solid rock.

Mr. DENISON: Do you remember any case where one town has been allowed to take anything more than a comparatively small quantity of the drainage area of another town—anything like 1100 acres out of 1500?

Witness: I am not aware of any particular instance; but there are instances where more than one town has the same watershed.

Witness was here cross-examined on the several petitions of the riparian owners, but no new points of interest were brought out.

Re-examined by Mr. PRICE: Do you know any company who have allowed their powers to expire, to claim the district as their own?

Witness: I have looked upon it as an abandonment of the district. I deem this new district we propose to take to be available for anybody that can get there. In reference to the supply of water which we propose to give to Ulverstone—whether it be to the local board or to the water works company—I have taken into account the probable increase of the town and its requirements, and I believe the quantity we propose to give them is quite sufficient.

Mr. MICHAEL: According to the notice which has been served upon Mr. Fell by the promoters of the bill, the site of the reservoir was to have been on Mr. Fell's property, was it not?

Witness: It has never been altered.

By the REFEREE: The present available drainage area of Barrow is 692 acres. The drainage area of Ulverstone under their bill is about 1600 acres.

The REFEREE: But still the natural available area for Ulverstone is more than that is it not?

Witness: It would be about 5000 acres.

The REFEREE: According to the map, the Newland Beck, the Gill Beck, and the Barn Beck are important streams. Have you gauged the flow of the Pennington Beck?

Witness: Only for a short time, so I am not prepared to give any details. From the 692 acres there is a dry-weather flow of something less than 100,000 gallons. If the supply were taken from the 1200, there would be a yield of 200,000 gallons; and from the 1600 there could be got 300,000; and that is all, in a certain condition of things, Ulverstone could obtain for a supply of water. This is an estimate made from the rainfall in that immediate neighbourhood.

Mr. *Bateman*, examined by Mr. LASCELLES.

I am a civil engineer. I accompanied Mr. Stileman and Mr. Graham over the Pennington Beck six weeks ago. I have examined the plans and gone into the details of the scheme. I have also examined the works of the Ulverstone Water Company, and the point at which they take the water from the Pennington Beck. Their Act authorized them to take from the beck at Pennington mill 600,000 gallons of water per day. They had also to make a reservoir to have an area of no more than six acres. That reservoir was never made. Their present storeage is insufficient, inasmuch as the quantity of water flowing down the beck in dry weather is considerably diminished. The population of Ulverstone is about 9200. They are at present supplied at the rate of about 20 gallons per head per day. The whole drainage ground of Ulverstone is about 1600 acres, and the produce of that in dry weather does not exceed 300,000 gallons a day.

Mr. LASCELLES: From that it is to be inferred that the company does not take nearly so much water as it might do?

Witness: From the arrangement of their works they cannot get any more water. The Barrow Corporation propose to make a reservoir to contain 140 million gallons of water, which will be conveyed by a tunnel from the intervening ridge to Poaka Beck reservoir. That is the whole of the work proposed to be done, for from the Poaka Beck reservoir to Barrow pipes already exist which will enable the whole of the water to be conveyed to Barrow. There will still remain about 450 acres of the Ulverstone watershed untouched, which will yield them 100,000 gallons a day in dry weather; and this, in addition to the 600,000 we propose to give them, will make a total of 709,000 gallons a day. Our proposed works are very easy of execution, the ground being very suitable for the construction of works. Taken in connexion with the existing works, this scheme will give to Barrow certainly more than a million gallons a day. I should say 1,250,000 gallons, after deducting the supply to be given to Ulverstone. It is not often a scheme like this can be got to benefit two parties at the same time. It would be a benefit to Ulverstone in every way, and the cheapest way in which water could be obtained for Barrow.

Cross-examined by Mr. SALISBURY: Knowing all the circumstances of the case, I think that 600,000 gallons is a fair quantity to be reserved for Ulverstone. It is more than it will require for a long time, and it will save expenses. If they require more water than the 600,000 gallons there is plenty of land to get it from.

Mr. SALISBURY: In the Act we are bound on demand to supply the railway company with 40,000 gallons at ½d. per 1000 gallons.

Witness: That has never been required. Besides, that would only be a small portion of 600,000.

Cross-examined by Mr. PEMBER: The available rainfall from the 692 acres is about 30 inches. Their storeage capacity amounts to as much as is prudent of the available rainfall of these 692 acres. There is some rain water which runs to waste.

The CHAIRMAN: Will the intercepting of the water from Pennington Beck to Pennington Mill leave it dry?

Witness: Supposing the Ulverstone Water Company had exercised all the powers contained in their Act of 1862, they could convey it away whenever their brook yielded it. If the brook did not yield more than that, every drop of water would be taken out, and the stream below Pennington Mill would be dry. The Barrow Corporation take two-thirds of the acreage, and the remaining third, which would yield about 100,000 gallons, would be available. If, therefore, the Barrow Corporation took 400,000 gallons from their works and sent it into the pipes of the Ulverstone Company without interfering with the parties below their reservoir, they would not be injured. At present the Ulverstone Water Company have it in their power to dry the whole beck if they exercised the powers in their bill.

Mr. PRICE: Are you of opinion, considering the position which the riparian owners are now in of having that beck completely dry if the Ulverstone Company took all they proposed to take, that the riparian owners by this scheme will be relieved from all danger of such an occurrence if the district from which they now take water is free from the operations of the Ulverstone Company?

Witness: The riparian owners would be put in a different position. At present the Ulverstone Water Company have power to take all the water.

Mr. PRICE: If the proposed works are carried out, and Ulverstone supplied from them, will the riparian owners not be in a better position than they are now?

Witness: Yes, they would; if the Ulverstone Company were precluded from taking any water other than that which they would be supplied with by the corporation from the new reservoir. The riparian owners would be 100,000 gallons a day better than they are now.

This concluded the case for the promoters.

Mr. PEMBER addressed the committee on behalf of Mr. Sunderland. He complained that there had been no clause put into the bill for compensating his client with water, and characterized the scheme as much too large for Barrow, as the present supply of water was perfectly adequate for all its wants. He urged, that unless some compensation clause were put into the bill, that it should not be passed, and if it were, he would reserve the right of opposing it in the other House.

Mr. THESIGER addressed the committee for Mr. Fell. He said that, considering some arrangement was likely to be made between the promoters and the Ulverstone Local Board as to water compensation, his client was not in a proper position to judge the case fairly until that arrangement had been completed, and that he had therefore decided not to offer any further opposition to the bill at present; and should it turn out, after such arrangement was made, that his client would be in any way damaged, he would have an opportunity of having his grievances redressed in another place.

Mr. YORKE stated that he had adopted the same course on behalf of his client.

Mr. SALISBURY then addressed the committee on behalf of the Ulverstone Water-Works Company. He said that considering the decision the committee had come to yesterday, to refuse to hear evidence on the question of the cost on the alternative scheme, it would be unnecessary for him to call any witnesses, and he would therefore not do so. The case had assumed a different aspect since it had come into the room, after having heard the evidence of Sir James Ramsden and Mr. Schneider, for now it appeared that the Barrow Corporation would be inclined to give a water compensation to the Ulverstone people. The Ulverstone Water Company had powers under their Act to supply the district, and the committee would admit that there was scarcely a case like this on record, where a company took the watershed of another, and then came into the same district in competition with them. The corporation had not called a single witness from Ulverstone to say that they were unsatisfied with the present supply of water; in fact, they had made no case of any kind to justify the committee in passing the preamble of the bill.

Mr. PRICE briefly replied.

Counsel and parties were then ordered to withdraw. On their re-admission,

The CHAIRMAN said that the committee were of opinion that the preamble of the bill had been proved. With regard to the Ulverstone Water-Works Company, should no previous arrangement be come to by the parties, the committee were prepared to protect their rights by putting in a clause for compensation in water.

THE MUTUAL GAS COMPANY, BUENOS AYRES.—The *Standard* of Buenos Ayres of April 22 says: "To-day the plans of the new Mutual Gas Company's fabric were placed in the Bolsa, and attracted universal admiration. The retorts will be capable of making 1 million cubic feet per day, and the coal store capable of holding 4000 tons. Everything seems to be perfect, and we trust, when the fabric is complete, we shall not be disappointed. The capital of this company is only 1 million dollars, or £200,000, and the producing power equal to three times Montevideo, so that if the shareholders only earn an amount equal to Montevideo last year, the results would be 25 per cent. profits on the total capital. Few enterprises pay better than gas companies in South America; and both the Buenos Ayres and the Rio works may be cited as examples. We observed the profits of the Rio Company in 1871 were nearly £100,000, and we believe their business is steadily increasing. What we wish to see is Buenos Ayres suburbs lighted like Rio, and with the Mutual Company we are promised this." [The above works were designed by Mr. G. Bower, of St. Neots, who, we believe, is now actively engaged in carrying out the contract for their erection.—ED. J. G. L.]

DUNSTABLE WATER SUPPLY.—The new works for the supply of this town were opened on the 20th ult. They consist of the engine and boiler-house, an ornamental building erected on the land adjoining the London and North-Western Station, which the company acquired for that purpose under the power of their Act. The pumps, the barrels of which are 50 feet from the surface, are three in number, and arranged with valves for working either independently or together. They are driven with gear by a pair of high-pressure expansive horizontal engines (which are arranged for having surface condensers added), so designed that they can be used together or separately. The well is in the engine-room, which is to be paved with encaustic tiles, and will have a pleasing effect. The steam is supplied from a Cornish boiler in the ordinary manner, a second one having to be added at a future time, and for which the boiler-house is arranged. From the well the water is pumped into the reservoir, which is situated on the highest point in the parish, near the Half Moon, rather more than a mile and a quarter from the pumping station, and at a height sufficient to deliver water to the top of any house. It is 40 feet square, by 15 feet deep; and is composed of brickwork laid in and lined with cement, it is covered in with arches resting on brick pillars. From the reservoir the water is supplied to the town through the various sluices, which are so arranged as to divide the town into districts. The water is raised from a boring in the chalk, and is of excellent quality, and will be on constantly. The whole of the works have been designed by Mr. Arthur F. Phillips, Assoc. Inst. C.E., of St. Albans, by whom the plans and specifications have been prepared, and under whose superintendence the work has been executed.

HOLDEN'S APPARATUS FOR CHARGING AND DISCHARGING GAS-RETORTS.

The apparatus described and illustrated below is the invention of Mr. J. J. Holden, one of the patentees of a former invention for a similar purpose which has been in operation at the Alliance and Dublin Consumers Gas Company's works for some years.

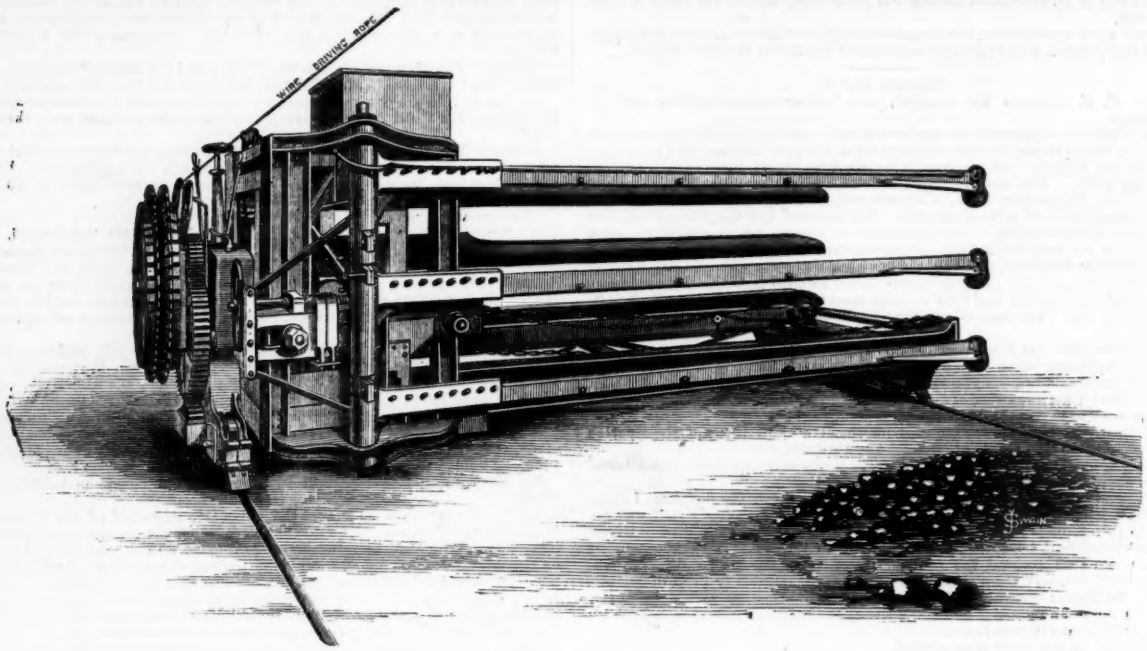
This patent, which is another of those lately purchased by "The Steam Stoker Company, Limited," was designed by Mr. Holden for the purpose of meeting objections made by some parties to the above-mentioned invention. The working of the machines by an endless wire rope from a stationary engine at one end of the retort-house obviates the necessity of having an engine to each machine, and by the swinging of the scoops and rakes, as hereinafter explained, the large coal hopper, with its consequent weight, is also dispensed with.

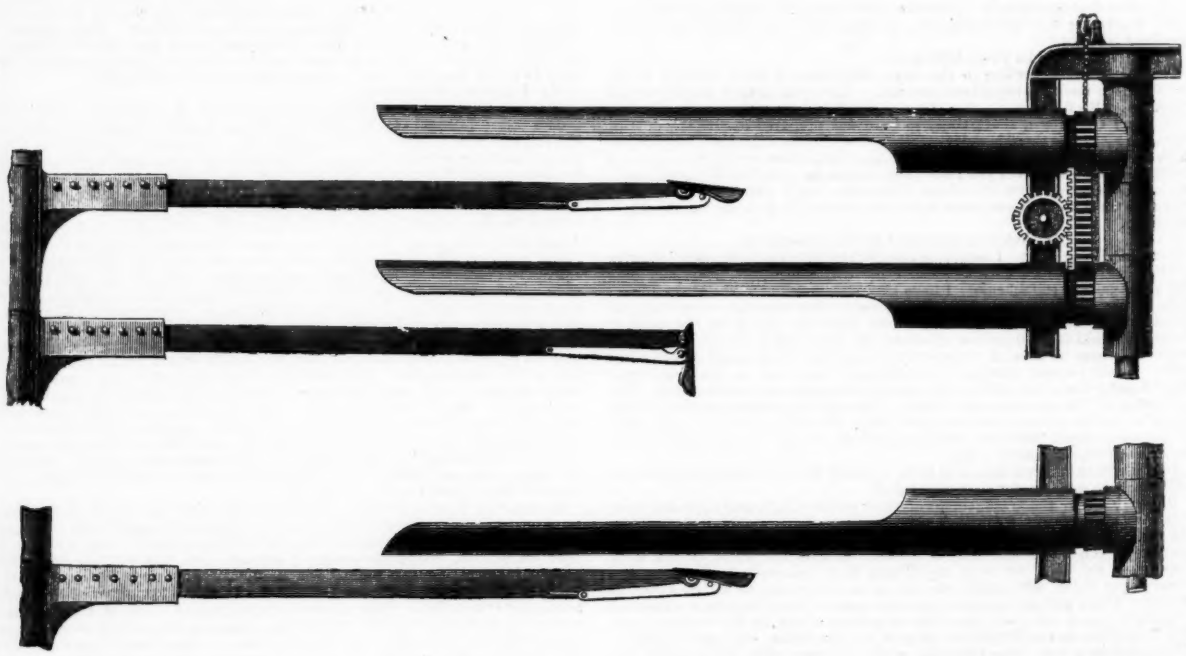
It is almost impossible, without the aid of a more complete set of drawings than our space will admit of, to accurately describe the invention, but the following brief description thereof may be found not uninteresting to our readers.

The apparatus consists mainly of the following parts:—A strong iron frame, called the "traveller," running upon trams or rails the whole length of the retort-house parallel with the mouths of the retorts; to this frame are secured rails in a transverse direction, upon which runs a secondary frame termed the "carrier." Attached to one side of this is a stout upright spindle to which are secured three scoops. These are hollow semicircular receptacles *half the length* of the retorts, capable of containing the proper charge of coal for each of the mouths of the latter; one end is made tubular, and, embracing the spindle, is free, when the latter makes a revolution, to revolve with it. These scoops (which can be made to work either separately or together, charging therefore either one, two, or three retorts at a stroke) are reversed on their respective arms by means of a pinion attached thereto, and worked by a rack, chain, and weight, and are prevented from discharging their contents until fairly within the retorts by means of a suitably arranged "cam" and "detent."

On the other side of the "carrier" is a similar spindle supporting three rakes, which swing in the same manner as the scoops, and the heads or tips of which can be adjusted by a hand lever actuated by the rakeman.

A shoot, fitted with suitable hoppers and valves for discharging the coal into the scoops, can be attached to the machine, and completes the apparatus.





A pair of these machines are calculated to charge and discharge four times in 24 hours 300 double retorts with 600 mouthpieces.

The wire rope by which the machines are driven passes over two large grooved wheels attached to the machine, from which the power is transmitted to its various parts by gearing so contrived that any portion of the machine can be set in motion or stopped without interfering with the remainder.

The scoops can either be charged by hand labour (in which case three men can fill them) from the retort floor or by a shoot from a coaling stage so arranged that no coal need be deposited on the floor of the retort-house.

If by the latter, the shoot being brought under the coaling stage, is filled with coal, and the spindle on the "carrier" is swung round, bringing with it the scoops, until they are each under their respective hoppers; the valves being then opened, the necessary quantity of coal (which can be regulated according to the heat of the retorts) is placed in each scoop, and the latter are then swung back into their former position opposite the mouth of the retort.

The "carrier" then moves on the "traveller" until the scoops are propelled into the retorts, when the "detent" being released, the weight descends, and by so doing overturns the scoops and discharges their contents. If desired, a spring may be used to effect the same result instead of the weight. The "carrier" is then drawn back until the scoops are clear of the retorts, when they reverse themselves. The retort doors are then closed, the manufacture of gas proceeds, and the scoops are ready to be again refilled.

While the scoops have been performing this duty the three rakes on the corresponding spindle on the other side of the "carrier" can be employed in drawing the charges from an adjacent set of retorts, the two operations of charging and drawing being thus carried on simultaneously.

The number of men required to work a pair of these machines, say for 12 hours, is as follows, viz. :—

One stationary engineman.
Two machine drivers, one on each machine.
Two rakemen, to swing and adjust the rakes.
Two men to open and close the retort doors.
Two men to swing the scoops.

If the scoops are filled by hand labour, four men will be required in addition to the two last mentioned scoop-swingers, who would then assist in this operation, but some of these may be dispensed with if the retort-house is fitted with a coaling stage and shoots as proposed.

One of the great advantages possessed by this invention is, that by its use the mouths of the retorts are only kept open for a much shorter space of time than when hand labour is employed. As during this period either the gas is escaping or none is being made, this forms an important item.

As regards cost, the saving effected by the dispensing with the bulk of the hand labour usually employed, and the increased facility with which the retorts are charged and discharged will soon recoup the cost of the machines, and must commend them to the attention of all who are interested in the cheap and economic production of gas.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary Meeting of Proprietors of this Association was held at the City Terminus Hotel, Cannon Street, London, on Tuesday, May 27—PHILIP TWELLS, Esq., in the chair.

The SECRETARY (Mr. Albert F. Jackson) read the notice convening the meeting.

The CHAIRMAN, on affixing the corporate seal to the register, stated that the present number of shareholders in the association was 1653, being an increase of 62 since the last meeting.

The SECRETARY read the following report of the directors for the half year ending Dec. 31, 1872.

Imperial Continental Gas Association, No. 31, Clement's Lane, Lombard Street, London, May 27, 1873.

The present half-yearly ordinary meeting of the shareholders has been convened agreeably to the company's Act of Parliament, for the purpose of receiving a report from the president and directors upon the affairs of the association, and for declaring a dividend for the half year ended the 31st of December last.

Gas Made.—The total quantity of gas made at all the stations in the half year ended the 31st of December, 1872, was in round numbers 2589 million cubic feet; the total quantity made in the corresponding half year of 1871, was 2381 millions, bring an increase of 208 millions, or at the rate of 8·72 per cent. increase. The increase of the same period of 1871 over that of 1870 was 11·50 per cent.

Lights.—The total number of lights at all the stations on the 31st of December, 1872, was 1,017,458; the total number of lights on the 31st of December, 1871, was 919,212. These figures show an addition of 98,246, or at the rate of 10·69 per cent. The increase of the same period of 1871 over that of 1870 was 7·13 per cent.

Mains Laid.—The total length of mains laid at the end of 1872, was 1160 miles 841 yards, bring an increase of 45 miles 1499 yards on 1871.

Secondary Products.—The value of the secondary products, coke, tar, and ammonia, was 71·34 per cent. of the cost of the coal, bring a decrease of 2·63 per cent. on 1871, when it was 73·97. This decrease is attributable to the great advance in the price of coal and to the exceptional mildness of the early winter in Holland, Belgium, and Germany, which considerably diminished the demand for coke.

The workings at the several stations of the association, the result of their operations, and generally the business of the association, conducted as they have been with unremitting assiduity and judgment by the principal superintendent, and the engineers and other officers who have co-operated with him, have continued satisfactory.

The rental for the half year now under consideration was larger than for the corresponding half year of 1871. The profit in the half year was £166,110 4s. 1d., being £13,108 less than the profit in the corresponding half of 1871. The diminution in the profit, notwithstanding the increase of the rental, is to be accounted for mainly by the increased cost of coal, by the diminished proportionate value of the secondary products, and by the increased cost of labour.

As regards the contracts with the English collieries extending over the whole season of 1872, the prices of coal remained the same for the second half as for the first half of 1872. But on comparing those prices with the prices of the corresponding or last half of 1871 there was a serious increase. As regards the entire quantity of coal delivered from all sources to the association during the last half of 1872, its cost (including all expenses, freight, &c., &c.) was about 7 per cent. per ton more than for the corresponding half of 1871.

The total excess of coal expenditure in the second half of 1872 over that in the corresponding half of 1871 amounted to about £54,000.

At Vienna apparatus of considerable extent has been put up, including two 100 feet gasholders, two new retort-houses, new beds of retorts, together with about 35,000 yards of variously sized mains.

At Berlin a new 80 feet gasholder and tank, and a house for offices and dwelling, have been erected in the suburb of Schoneberg.

At Brussels a new 70 feet gasholder has been put up to replace an old one.

A large supply of mains of various sizes, and in quantities more or less considerable, has been furnished to Hanover, Aix-la-Chapelle, Rotterdam, Berlin, Frankfort-on-Maine, Amsterdam, Antwerp, Ghent, and Lille.

The president and directors would now draw attention to the accounts for the half year ended the 31st of December last. From these accounts, which have been duly audited, the directors have, in accordance with the provisions of the "Companies Clauses Consolidation Act," prepared a scheme showing the profits of the association for the past half year, and the portion thereof applicable to the purposes of dividend, which the president and directors recommend now to be declared—namely, a dividend of £2 per share, payable free of income-tax on and after the 16th of June next.

The directors who go out of office by rotation are Henry Wood, Esq., John Wilkin, Esq., and Nathaniel Montefiore, Esq. The auditor who goes out is Joseph Sebag, Esq. These gentlemen are all eligible for re-election, and offer themselves accordingly.

The CHAIRMAN: Gentlemen, I beg to move that the report you have just heard be received and adopted. Before I refer to the details of it more particularly, I would express, as on some former occasions I have been called upon to do, the great regret we all feel on this side of the table at the absence of our venerable president. We had hoped he would be here, but this morning I received a letter from him, in which he tells me that he is not able to undertake the journey to town, and at the same time requests me to assure the meeting how deeply he regrets this inability, and to offer to you his congratulations on the satisfactory position of the association under recent unfavourable circumstances. At our meeting this time last year you will remember that we had the pleasure of seeing Sir Moses Montefiore here in very good health. It is gratifying to know that he still continues to enjoy the same, but he feels that a journey to London would probably subject him to more fatigue than would be desirable for him. There is one old friend whose removal by death we have to regret. I refer to our long known and esteemed accountant, Mr. W. Walton. Most of you are aware that for many years he was in the service of the association, and you know with what assiduity, regularity, integrity, and wonderful precision he discharged at all times the duties devolving upon him. He died at an advanced age. We all respected him as a friend, and every one who had the opportunity of communicating with him will bear testimony to his cordiality and general excellence of character. On this occasion we have the pleasure to see our old friend, Mr. Drory, amongst us. I am afraid he has succeeded in persuading himself that he is not so young now as he once was; but for myself I see less difference in him. He has lost, perhaps, some of the elasticity of youth, but his experience has become more matured, his interest in the association is as strong as ever, and he is now as much distinguished for those qualities which render him so valuable to us as at any previous time. I hope we may long continue to see him at our meetings. With regard to the operations of the association during the last six months, the report will, I trust, have convinced you that they have been exceedingly satisfactory so far as the working is concerned. The quantity of gas made has very materially increased, and the number of lights has now for the first time reached a million! The length of our mains has been much augmented, and all these facts show the extent to which our services are appreciated abroad, and the great amount of advantage which the inhabitants supplied from our different stations derive from our exertions. At the same time, so far as we are concerned as an association, we have to look upon it as a dividend-producing concern rather than as a philanthropic organization for throwing light upon others. Our profits are not quite up to the amount of former years. I believe this is the case with almost every gas company in existence. The unprecedentedly high charges for coal have, of course, had a great and serious effect upon the profits of all such companies. In England, and many other places, the price of gas has been very generally raised to meet this exigency, and this is a subject to which your directors have given their best attention. But we are placed in a difficult position. Wherever we have had the opportunity of raising the price of gas we have done so; but this increase has only changed our average price to the extent of the fraction of a penny per 1000 cubic feet, if you take all our stations together; for we have frequently found this to be the result: the stations where we should like best to have raised the price—where, for instance, the consumption is the largest—these are the places where the profits are the largest, and we cannot expect that the inhabitants of one town will allow their prices, which are already fairly remunerative, to be unnecessarily raised because the inhabitants of another town do not provide their fair quota to the amount of profit we think we ought to derive in this undertaking. In some few places where we thought the price ought to be raised, we have applied to the local authorities to allow us to charge rather more than the maximum price fixed by our contracts; and I regret to say that those authorities have not treated us with quite so much liberality as we thought we might expect, and the permission has been withheld. Whether, if the present high price of coal should continue, they may be induced to alter their determination, I cannot foresee; but at present they have bound us to the terms of our contract. In the meantime we may compare the amount of our own dividends with those which are received by other companies, and endeavour not to be altogether dissatisfied with our present condition, while we lose no opportunity of improving it. With regard to our future prospects, they are not so bright as I should like. We have suffered much in the past half year from the price of coal, but I am afraid the pressure has not reached its maximum. During a part of 1872 we were paying for our coal the comparatively low price which ruled in the beginning of the year. That price was high as compared with the price in 1871, but low in comparison with the sums we shall have to pay in 1873. I fear, therefore, that our returns for the current half year will not show so favourable a result as you find in the report now before you. At the same time, as far as we may venture to express a hope, I shall certainly feel surprised if they do not reach a figure which will enable us to keep up our dividend to some such a rate as we are able to offer to-day. During the last few weeks our connexion with the city of Cologne has been brought to a termination, with the exception of one small works in the suburbs. You have frequently heard in this room of the tedious litigation we have had with the town authorities there, as to whether they were entitled to take the supply of gas into their own hands. That matter is now settled, and a few weeks ago we gave up possession to them of our works. We have received a large portion of the money they were to pay for them, and the settlement of the other items under discussion will, I trust, be shortly arrived at. We have told them that, having sustained a good bold fight as long as we thought ourselves bound to do so, we are now prepared, as the decision has been given against us, to carry out that decision without any vexatious opposition, and in as fair and conciliatory a spirit as we can. It having been settled in their courts of judicature that the works belong to the town, we say, "Take them, and we will render you all the aid in our power." They seem disposed to meet us in the same spirit, and with regard to any items which are still open between us, I hope they will be speedily arranged in a friendly way on both sides, and that any further litigation may be avoided. With reference to Antwerp, we have been for some time negotiating for a new contract, and we are in daily expectation of hearing that the municipal authorities there have agreed to extend the term and give us a new concession on conditions which we are prepared to accept. There is only one other station which has lately caused us much uneasiness—namely, Bordeaux. The authorities there have been in negotiation with us, and have also received offers from other parties, and they appear to have been playing off one party against the other to such an extent that one of our competitors felt so aggrieved at their treatment that he withdrew his caution-money and left the town. I do not know that I can offer any further observations which would interest you, but if it occurs to any proprietor that I can supply any additional information, I shall be most ready to do so if it is in my power. I move —"That the report upon the affairs of the association now read be received, adopted, and entered upon the minutes."

Mr. VYVYAN: I am most happy to second the adoption of the report. I have been a member of the association 30 years, and feel that I can do so with perfect confidence. Considering how enormous has been the rise in the price of coal, I can only express my surprise and gratification that the directors are able to give us so favourable a report to-day.

Mr. F. BASSETT, M.P.: We have heard from the chairman of the termination of the Cologne contract. I suppose we have not come out of that business upon worse terms than we might expect from the entries in the books. Possibly the directors may not wish to enter fully into particulars; I know that these things are rather delicate to deal with, and, therefore, I shall not press the point. We generally are better than we appear, for we have a most careful set of directors, who never have an account cooked up to please the shareholders at the expense of truth.

Mr. PRICE: I rather agree with the last speaker that our accounts might sometimes be a little more cheerful, for we generally find results are better than we anticipated. I trust it may be so in this instance. There is one point upon which I should like to make a remark, and that is with regard to our investments in Consols. I think we might do better with our money. Consols at the present time pay only 3¼ per cent., and I would suggest, as I suggested some years ago, that we might find some other and perfectly safe means of investing our money which would yield a better return. Another question with reference to Cologne; I should like to know on what terms the authorities are taking our works—whether there has been a valuation of them, and, if so, whether the amount at which they were assessed is satisfactory to the directors? With regard to Bordeaux, I did not quite understand our position, and if this is not information which it would be injudicious to publish, I should like to know exactly how the matter stands. Again, did I understand that the concession at Antwerp had been renewed? and, if so, are the terms satisfactory? Again, with regard to coals, are the directors still getting all their supply from this country, or are they obtaining some from the mines in Germany? I have heard of a wonderful colliery there in which such a seam has been discovered as was never before known. I should like to ask whether Mr. Drory has heard of it, and can give us any information on the subject.

Mr. KEENLYSIDE: I should like to understand what will become of the amount to be received from the sale of the works at Cologne—whether it will go to the credit of capital account or be absorbed in the contingent-fund? The scheme brought forward every half year for the appropriation of our profits always commences the same way—"Expenditure so much; reserved for contingencies so much, leaving a net sum of £112,000 for dividends." There never appears to me to be any difference in the amount reserved for dividend. The directors do not seem to look at how much they could give us, but at how much they can carry to the contingent-fund, so as to leave a round sum of £112,000 for dividend.

The CHAIRMAN: With regard to our investment in Consols, it is undoubtedly desirable to obtain as good a rate of interest for our money as we can with prudence, but it is of still more importance that we should have that money under our control, so that we can make it available at the shortest notice. During the war between France and Germany there was great difficulty in obtaining bills in the ordinary way for remitting money to places abroad, and we then found the advantage of having money under our control which we could lay our hands upon in 24 hours. The directors are quite aware of the importance of the subject, and will not lose sight of it. In reply to the question whether we are satisfied with the terms proposed in connexion with Bordeaux, Cologne, and Antwerp, I may make one general statement that on this side of the table we are seldom quite satisfied with the arrangements we are driven to accept; we do not often think that the authorities exhibit quite so much liberality to us as we endeavour to show to them. At Cologne there had been a long-protracted litigation, the question being whether we could claim the right to continue to supply that city for a longer period, or whether they were entitled to buy the works of us. The decision of the court was in their favour on the latter point, and in pursuance of that decree, and in accordance with the terms of our contract, experts were appointed by both parties and approved by the court to decide upon the sum to be paid to us. The sum assessed by these experts is larger than the amount at which the works stood in our books, and therefore we could not altogether look upon it as an unreasonably small amount. At Antwerp we have had to submit to a reduction in some of our prices; but, taking into consideration the prospect of a reduction in the cost of coal there, it was a concession we were not unwilling to make, and therefore we cannot say the arrangement is altogether unsatisfactory. The new contract is not entirely concluded, but the chief points have been arranged, and we hope to hear in the course of this month that the contract will be finally settled. With reference to Bordeaux, the hon. proprietor asks whether the negotiations are hung up for the present. The offers we made are still open for the town to reject or to accede to; but they have not yet come to any determination whether they will or will not invite fresh tenders from other parties. However, in a short time they must come to some decision, and I can only say that if any other company takes the supply at a lower price than we offer, we should have little inclination to take the concession with such unremunerative stipulations. On the question of coal supply I would observe that with our connexion with Belgium, France, Germany, and Austria, we have the most ample means of ascertaining the price and quality of all the seams ever resorted to in those countries for gas-making purposes. It is a matter which is constantly under the observation of Mr. Drory, who is also in frequent communication with the board on the subject. A very large proportion of our coals—much larger than usual—was last year obtained from the continental collieries. There are various considerations involved in the question. We have to look not only to the price of coal at the pit's mouth, but also the freight, the charges for railway carriage, and other points; and I may venture confidently to assure the meeting that the coals have been obtained in the most advantageous manner that could be adopted. The subject of the fund for contingencies has been so frequently discussed at our meetings that I am really unable to say anything new about it. The only sum we try to keep stereotyped is that which is applicable to dividend. We, as directors, should be very glad occasionally to reduce it, so as to leave us a larger sum to expend on extensions. We are not always quite sure what we may require, so that we use our best endeavours to keep our dividend-fund at £112,000, and we are obliged to make our extensions larger or smaller in each half year, as the case may be, so as in meeting the necessities of our stations we do not incur any debts. Beyond our ordinary wear and tear there is constantly arising a necessity for further expenditure in the nature of extensions. For instance, during the last half year at Vienna we have been obliged, in consequence of the Exhibition, to extend our mains enormously, to put up a great number of additional lamps, increase our retort power, our gasholders, and other things at a great expense. These are, however, extensions which the city by their contract with us are entitled to insist upon our making, and have required us to make, and we can only meet them out of the difference between the gross amount of profits and the amount reserved for dividend, unless we make a call upon the shareholders, or (as in the present year) happen to receive some return of capital from one of our stations. When a concession ceases, the local authorities of the town in question are, in some cases, at liberty to purchase our works at a price to be fixed by experts. But that is not the case at all our stations, in some of which there is no limit to our right to supply gas to private consumers, and then the towns are not at liberty to insist upon purchasing our works under any circumstances, while in others they can turn us out without paying anything. Our recollections of Marseilles furnish a disagreeable case in point.

The motion for the adoption of the report was then put and carried unanimously.

The CHAIRMAN moved—"That a dividend of £2 per share be declared upon the shares of the association for the half year ended the 31st of December last, and that the said dividends be payable (free of income-tax) on and after the 16th of June next, as recommended in the report."

The motion was put and agreed to.

The retiring directors and auditors were unanimously re-elected.

Mr. PRICE moved—"That the cordial thanks of the meeting be given to the president and directors for their able management of the affairs of the association, and to the chairman for his conduct in the chair this day."

Mr. TURNER seconded the motion, which was carried unanimously.

The CHAIRMAN: Gentlemen, I beg to offer you our united best thanks for this renewed mark of your confidence, and can only assure you that our best efforts will continue to be given to promote the welfare of the association. There is one resolution which, before you separate, I should like to submit to you. You all know that however assiduous the directors may be, their efforts would be, comparatively speaking, of small avail, if it were not for the services of our general superintendent, Mr. Drory, and the other officers of the association. Their unremitting attention, skill, and energy are entitled to our warm approval, and I therefore ask you to join in a cordial vote of thanks to them on this occasion.

Mr. PRICE seconded the resolution, which was carried by acclamation.

Mr. DRORY having bowed his acknowledgments, the proceedings terminated.

PETERBOROUGH GAS COMPANY.

The Ordinary Half-Yearly Meeting of Shareholders was held on Tuesday, May 20—Mr. WM. HARRIS in the chair.

The report of the directors was as follows:—

The revenue account for the actual half year's working shows a balance of £2469 4s. 4d.

The balance of the profit and loss account for the half year (after transferring the sum of £200 to the contingent-fund) amounts to £2269 4s. 4d., out of which your directors recommend the payment of a dividend after the rate of 9 per cent. per annum on the ordinary share capital, and 7 per cent. per annum on the new ordinary share capital, free from income-tax, payable on and after the 31st day of May next, leaving a balance of £1106 14s. 4d. to be carried forward to meet the next half year's dividend.

The very satisfactory state of affairs exhibited by the accounts for the last half year is chiefly due to the very favourable contract your directors were enabled to make for coal in the month of May, 1872, which, although considerably higher than the terms of the preceding contract, has been more than met by the increase in the price of gas and the additional amount realized for coke and other residual products. The hope of your directors that the price of coal would fall before it became necessary to enter into another contract has been disappointed, and the rate to be paid for coal, for the next 12 months, your directors regret to say will, in all probability, very materially reduce the profits of your undertaking, inasmuch as you are limited by Parliament to a fixed maximum price for gas, whilst the cost of the material from which your gas is manufactured has advanced 125 per cent. since December, 1871; the increase under the contract expiring in June next being only 35 per cent. Your directors have, along with other companies, thought it right to petition the House of Commons, praying them to appoint a select committee to examine into and report upon the question, and your directors hope that some relief may be afforded to the companies during the present session of Parliament.

With reference to the extension of the works, your directors have entered into arrangements for the carrying out, in due course, of such part of the plan, recently laid before you, as they consider to be absolutely necessary to enable the company to meet its obligations. If circumstances had allowed, they would much rather have delayed the outlay in the present state of trade. They, however, believe that they are well advised that it would not be prudent or safe to do so. The works will be carried out in as inexpensive a manner as is compatible with durability.

Your directors, having had their attention drawn to the increase of duty falling upon the secretary since his appointment, feel themselves justified in recommending that his salary be increased £15 per annum.

The expenditure under the head of capital has been for extension of mains, service-pipes, and lamps in the Westgate House estate, Bright Street, and Acland Street.

A further sum of £211 2s. 10d., being the balance of the amount expended in alteration and renewal of mains in connexion with the erection of the Peterborough new bridge, has been carried to the debit of the contingent-fund. Your directors are glad to report the completion of the work, but they regret that such an unexpected outlay should have arisen.

The SECRETARY read a letter from the auditors (Messrs. J. F. Arnold and S. Bilton Smith) to the effect that, in handing to the directors a statement of the accounts and the balance-sheet of the company, duly audited and certified, they desired to express their approval of the manner in which the accounts had been kept. It reflected very great credit upon the manager, Mr. W. J. Moon, and could not fail to give great satisfaction to the shareholders generally.

On the motion of the CHAIRMAN, it was resolved—"That the reports and accounts be adopted, and that a dividend after the rate of £9 per cent. per annum on the ordinary share capital (free of income-tax) be declared payable on and after the 31st inst., as recommended in the report."

An amendment by Mr. SERGEANT to increase the dividend to 10 per cent. was negatived by a large majority.

The recommendation of the directors to increase the salary of the secretary was agreed to, and it was also resolved—"That in order to carry out the extension of the works necessary to meet the obligations of the company, the directors are hereby recommended and empowered to introduce a bill in the ensuing session of Parliament for obtaining further powers as to capital and otherwise."

A vote of thanks to the chairman completed the business.

NEW GAS COMPANY, LIMITED.

The First Ordinary General Meeting of this Company was held at the Cannon Street, Hotel, London, on the 21st ult.—Lord CLAUDE HAMILTON in the chair.

The SECRETARY (Mr. H. Brownrigg) having read the notice,

The CHAIRMAN said the meeting had been convened in compliance with the Act of Parliament, but the only business to be transacted was the election of auditors. The shareholders would, however, probably desire that he should address a few observations to the meeting, and state such few facts connected with the company as had occurred since its formation. In the first place he would observe that the shares of the company had been taken up in sufficient numbers not only to pay the price agreed for the patent, but also to leave a very ample margin of capital for carrying on the operations of the company, and for making all the preliminary experiments that were necessary before they could undertake any large operations. He might also state that the final specification of the second patent was filed on the 2nd of March. Those two points constituted the only absolute facts he had to mention; but there were other matters of general interest relating to the prospects of the company, and the proceedings that had been going on during the last four months, which he would now proceed to narrate. In the original prospectus almost the whole of the civilized world had been named as the area in which they intended to take steps with the view of securing patents. Since the publication of the prospectus, very great progress had been made in foreign countries in securing those patents which would prove a very valuable and large source of revenue to this company. In some countries the progress had been slow, but in all there had been a decided movement, while in some their negotiations had arrived at completion, and in others, matters had almost reached that state. With regard to such distant countries as Japan, there was naturally not much to report upon from them; but in the more important countries, as for instance France and Belgium, and the important colony of Canada, the most complete and satisfactory success could be stated. In regard to Russia, Portugal, Spain, &c., matters were not so advanced, and in regard to the Australian colonies longer time was naturally required. But there was not the slightest doubt that every arrangement set on foot would be eventually satisfactorily completed. With regard to their position at home, the board had had a very great number of applications from various persons, including some of the most important manufacturing firms and some of the leading engineers, who were anxious to try the new process, and to gain the great advantages which they believed must be derived from the use of the company's gas. The object that the board had had in view was to go forward safely and securely, and not to try a number of experiments in various parts of the country before they had been enabled to test it on a large scale and in its entirety. Therefore they had not been anxious to accept all those various offers, but had been desirous of establishing beyond doubt and cavil the perfect success of the patented process; as then they would be able to meet the various demands that came pouring in upon them. The shareholders would understand it was no easy matter to lay a hand upon a particular town or community where the company could at once experimentalize upon a large scale; but by great good fortune they had been able to secure the city of Chichester, a cathedral town of some importance, and containing about 8000 inhabitants. The gas there travelled through about 14 miles of pipes, so that the town afforded a good field for the trial. The works were remarkably well situated, and the company had secured the use of the smaller of the two gasholders. Having completed all the works necessary for attempting operations, they commenced to light the city and its surrounding villas and mansions, and complete success had attended the operation. The gas was of great beauty and great brilliancy, and everybody had been highly satisfied with the experiment. Naturally, the promotion of an enterprise like this, which they imagined would prove of immense value to the public, had excited considerable envy and prejudice, and many objections and disparaging statements had been made to the process patented by the company. He need not say that those objections were wholly unfounded, and they had proved so. The experiment made at Chichester was a complete success. He might here mention that the use of the gas required another burner to that ordinarily in use, and there were some other matters of detail, none of which, however, presented the slightest difficulty. All those of the shareholders who had read the prospectus were aware that beyond the revenue expected to be realized by their process of lighting gas they anticipated very great results from the heating gas, also included under their patents. With the view of obtaining a place suitable to experimentalize on a large scale, they had secured premises at Greenwich, and had it not been for certain legal difficulties in the acquisition of the property, which would shortly be removed, they would have been now in a position to announce, as in the case of their lighting gas at Chichester, the complete success of their heating gas when tested practically and on a large scale. This delay was, however, only temporary, and he hoped to be able to assure the

shareholders at their next meeting of the complete success of that portion of their operations. He would only further mention that in order that their operations should be carried on under the most scientific and able administration, they had secured the services of Mr. R. P. Spice as the company's manager. So completely was that gentleman convinced of the ultimate success of this scheme, and of the development of this company, that he had relinquished a most profitable business of his own, in order to undertake the position of manager of this company.

Messrs. Quilter, Ball, and Co. having been appointed auditors, with a remuneration of 30 guineas a year, Mr. R. P. Spice entered at some length into an exposition and defence of the company's patent process, and said that, having a name and credit to lose, he had no hesitation whatever in assuring the shareholders that the more he became acquainted with this system the greater became his confidence of its perfect success in the future. He was the holder of shares to the extent of £2000, and, if he could afford it, should hold a far larger stake in the company. In conclusion, he could only say that he was most thoroughly devoted to the service of the shareholders, and full of the most confident anticipations as to the future.

The proceedings closed with a vote of thanks to the chairman.

METROPOLIS GAS SUPPLY.

St. George's, Hanover Square, Vestry.—A special meeting of this vestry was held on the 20th ult., Mr. Leslie in the chair, "To consider and agree to a petition to the House of Lords to secure to the ratepayers the advantages gained by the Court of Queen's Bench and Court of Exchequer Chamber maintaining the Metropolis Gas Act, 1860." The petition was to the effect that The Gaslight and Coke Company should be called upon to put in force the provisions of the Act of 1860. The petition was read on the motion of Mr. Taylor, seconded by General Sir William Codrington, it being understood that Mr. Leslie should have certain powers in connexion with the petition in his capacity as chairman of this vestry meeting. The petition was approved and adopted by the vestry after being read, Sir William Codrington entering into an explanation of the course the Metropolitan Board had seen fit to take with reference to this subject. The chairman read a portion of a letter from Lord Redesdale to him on the subject, and the vestry decided that Mr. Leslie should appear before the House of Lords on their behalf in support of the petition if necessary.

Hampstead Vestry.—At the meeting of this vestry, on the 21st ult., Mr. Le Breton in the chair, a communication was received from the Imperial Gas Company, giving notice of their intention to increase their charge for lighting from £3 17s. to £4 6d. per lamp per annum from next month. Mr. Lowe, the surveyor, said there were 1011 lamps in the parish lighted by the Imperial Gas Company. Mr. Stone remarked that no provision had been made in the lighting-rate for this increase. Mr. Churchwarden Milton said it was equal to a halfpenny rate.

Marylebone Vestry.—At the meeting of this vestry, on the 22nd ult., Mr. Sedgwick in the chair, a letter from the Imperial Gas Company was read, stating that in consequence of the enormous rise in the price of coal, and all other material used by the company in the manufacture of gas, as well as the increase in the scale of wages, that after the 30th of June next they will be compelled to raise the price of the public lamps from £3 14s. 6d. to £4 3s. per lamp, which will bring the price of gas to 3s. 9d. per 1000. Mr. Boulnois moved a reference to the Parliamentary Committee. Mr. Moores said he attended a meeting of the ratepayers last night, and the feeling there was in favour of a special committee. Mr. Tavener said the company had treated the vestry liberally, and had promised a reduction in the price when coals were cheaper. Mr. Wilson thought the committee would do no good, as the vestry was in hands of the Philistines. Professor Marks did not believe there was any help. They might ask the company for a reduction, and they would get an answer which might come from Rome—*Non possumus*. Mr. Stevens was for taking action, as this increase was serious. Moreover, coke was treble the price it used to be, and these reasons of the company were simply a bugbear in order to induce the ratepayers to pay the piper. Mr. Tavener moved the appointment of a special committee. Mr. Boulnois having replied, the question was put, when the vestry decided to have a special committee.

Hackney Vestry.—At the meeting on the 23rd ult., a letter from the Imperial Gas Company was read, notifying their intention to raise the charge for gas for the public lamps from £4 8s. to £4 18s. per lamp per annum. The reason assigned for this step was the advance in the price of coals, and the board were assured that should a reduction occur in this respect the directors would make a corresponding reduction in the price of the gas. Mr. Runtz suggested the application of meters to the street-lamps, as the company could not charge more than 3s. 9d. per 1000 feet. He had no faith in the statements contained in the letter just read, for it was ridiculous to suppose that a great gas company like the Imperial were up to the present time affected by the rise in the price of coals which had taken place so recently. It was not likely that they would depend upon a "hand-to-mouth" supply, and in all probability their contracts entered into before coals became dear had not yet expired, and even if they had the company would be almost in the same position on account of the increased price they were obtaining for the residual products. The letter was referred to the General Purposes Committee.

Shoreditch Vestry.—At the meeting on the 27th ult., the clerk read a letter from the secretary of the Independent Gas Company, stating that in future the charge for lighting and maintaining the public lamps in the district of the parish which that company supply would be £4 5s. per annum.

THE RECENT GAS EXPLOSION AT MANCHESTER.

The adjourned inquest on the bodies of John Thomas Lawson and Robert Hodge, whose deaths were caused by an explosion of gas at the junction of St. Mary's Gate and Deansgate, on the 13th inst., was resumed on Wednesday, the 21st, by Mr. J. Makinson, deputy-coroner for the city of Manchester.

Mr. R. B. B. Cobbett watched the case on behalf of Eachus, the deputy-foreman of the works, under whose charge the operations were being conducted at the time of the accident; Mr. Sharp (from the office of Messrs. Thomas and Wharton), on behalf of the widow of Hodge; and Mr. W. Talbot, the deputy town-clerk, on behalf of the corporation. Alderman King, chairman of the Gas Committee of the corporation, and Captain Palin, chief constable, were also present during the inquiry.

Mr. Cobbett said before the inquiry was proceeded with, he wished to explain that he appeared for the man named Eachus, who gave evidence on the last occasion. He (Mr. Cobbett) had been called upon to appear from an understanding which Eachus derived from the newspaper reports of what took place on the occasion of the adjournment. When the man gave his evidence, he had no idea that he was anything but an ordinary witness, and it did not appear to have been intimated to him that he was anything else. But when they looked at the report of what had been said by the deputy-coroner, then he had a not unnatural impression in his mind that the sole object of the adjournment was to procure evidence against him. The words that particularly struck him were these: "They had no evidence to support the boy's testimony, with regard to a light being on the top of the syphon, and therefore it would be necessary to endeavour to bring forward other eye witnesses to give corroborative evidence." Of course his client would understand that to mean that the sole object of the inquiry, from the adjournment onwards, would be pointed against him. He (Mr. Cobbett) did not suppose that that was so, because the duty of the court was to inquire into cases of death generally, and not to get up cases against any one in particular.

Deputy-Coroner said the object of the adjournment was to inquire into the case generally, not only as to Eachus, but as to everybody else, and not only as to them, but with respect to the method of conducting these testings, and the question as to whether any precaution should be taken. With regard to Eachus—the evidence had been taken so far, but it did not become depositions until it was signed—he would be told that he need not answer any question; that he might have any part or the whole of his evidence expunged, or that he might add anything he liked.

Henry Eachus was then called, and his evidence was read over to him. In answer to the Deputy-Coroner, he said he did not wish to add or withdraw anything.

By Mr. Cobbett: He felt with his hands at each of the four bolts, the places where the gas would escape if anywhere. He tried the places with a light, which he afterwards put out, and he felt at them with his hand in order that he might detect any light which there might be, and which he could not see.

Robert Roscoe, a workman in the employment of Mr. Harrison, auctioneer, said he was working near the place when the pot was being tested. He saw a man with a lighted torch, which he threw down in some sand on the ground, and put his foot upon. He heard this man tell one of the workmen to disconnect the pipe, and the man did so. He saw no other light but the torch. At the moment the connexion was broken the explosion occurred.

By Mr. Cobbett: If there had been any light visible about the pot he would have seen it.

By Mr. Sharp: Several of the bystanders were smoking. He did not see any one strike a match, but he heard one of the workmen say, "I wish they would go away with their pipes."

Albert Wood, yeast dealer, Chester Road, said there was no rope round the syphon at the time of the testing. He was close to the man who tested the syphon with the torch, and saw no light coming from the end. The pipe had been disconnected when the explosion occurred.

By Mr. Sharp: He was quite sure there was no rope round the syphon. He saw no crowd of people watching the testing.

William Bennett, clerk, said he saw a light come out of the end of the pot at the time of the explosion, but he saw no light before the explosion. He was nearly sure there was no rope round the syphon pot on the St. Mary's Gate side. The explosion blew him five or six yards away, knocked him down, and burnt him.

By Mr. Sharp: He did not observe any one smoking.

Matthew James Cooke, joiner, Thompson Street, Oldham Road, said he saw the pot tested. There was no light at the end. If there had been he would have seen it.

There were several other spectators of the explosion in attendance, but they were not examined.

Deputy-Coroner said they had negative evidence that there was no light on the pot, as stated by Evans on a previous occasion. Unless they could get some corroborative evidence as to the existence of that light it was no use going on taking this negative evidence.

Deputy-Coroner, in reply to a juror, said it was clear that Eachus had put the light out before the disconnexion took place, for he was going down the hole when the explosion occurred.

A Juror: Is it not possible that there may have been a light at the other end?

Deputy-Coroner: Yes, but no one saw any light.

A Juror: There might have been a light underneath, which no one could see.

Deputy-Coroner: Yes, but we have no evidence about it.

Mr. *John Leigh*, medical officer of health for the city of Manchester, said he had made an examination of the pot since the accident. It was a pot of great strength, and he should think was intended for long endurance rather than for the purpose of resisting an explosion. In the first place, he might say that no mixture of air and gas was spontaneously explosive, and that therefore there must have been a light, or a heat not below that of low redness, to account for the explosion at all. The evidence he had that morning heard rather disposed him to believe that there was no flame at the connexion of the ends of the pipes. It was possible that ignition might have taken place after the disconnexion. There was no question that there was an explosive mixture in the pot, in other words that there was such a quantity of atmospheric air in the pot as to constitute with the gas an explosive mixture. An aperture through which there was a jet of burning gas about the size of a lighted lucifer match would be sufficiently large to cause an explosion. The explosion would take place at the weakest point. He had listened to the evidence with some interest to hear whether there was a possibility of a second explosion having been heard; first a slight, and then the more serious explosion which caused the loss of life. When the connexion between the syphon pot and the street main was broken, there would momentarily be a rush of gas from the street main, and that, mixing with the atmospheric air, would constitute an explosive mixture; and if a light had been present it was possible that a gentle explosion might have taken place instantaneously, and caused a more serious explosion, so that if there had been a light by, or a light not quite put out, an explosion might have been caused in that way.

Deputy-Coroner said that attention was directed to this point on the first occasion, and it was found that there was only one explosion.

In reply to a Juror, *witness* said that a spark from a tool used by the workman who disconnected the pipes would be sufficient to cause an explosion.

In answer to the Deputy-Coroner, he said that what he meant was that, given a spark and an explosive mixture, there would be an explosion; but in this case the spark could not have caused the accident. The fact of the explosion taking place at the moment of the disconnexion showed that the explosion could not have been caused by the process of gaseous diffusion. Supposing the explosion to have occurred by the rush of gas at the point of disconnexion to a naked light, it might be that the two explosions would follow each other so closely that more than one would not be recognized.

By a Juror: He thought Eachus could feel a light with his hand if there was one. If the pot had been full of pure gas the explosion could not have happened. If there had been a mixture of atmospheric air in the pot the explosion could only have happened by contact with a heat of not less than low redness. He did not agree with Eachus that if the pressure was withdrawn from the main and there was a light at the end of the pipe, an explosion would ensue; it was not so much a question of pressure as of mixture.

Deputy-Coroner: Do you know any other method by which the pots could be tested?

Witness: Oh, yes; they might be tested by water pressure. No doubt in future that will be done.

Deputy-Coroner: And that is a perfectly safe method of testing?

Witness: Quite safe. If the pot had been tested in a hole, he could not tell what the result of an explosion would have been. The pot might have been lifted up into the air as a boiler sometimes was in the case of an explosion. He had no doubt that exhaustion of the pot was carried out to within 20 or 25 per cent. of atmospheric air; if there had been more, the explosion would have been more violent. He knew of no other means of ascertaining whether the pot was full of pure gas, within reach of the man, than those he used.

Mr. Sharp: Supposing a rope had been left smouldering, would that emit sufficient heat to cause the explosion?

Witness: I think it might. If the rope were at a red heat, and the gas reached it, there would be an explosion.

John Clough, of Westhoughton, draper, said that shortly before the explosion occurred he saw a large light on the top of the syphon, but he could not say

whether it was caused by a lighted rope or by a leakage of gas. It might be the light of a piece of rope. He saw several people standing close to the pot, and after the light had been extinguished or had disappeared he saw a young man put his hand on the rim of the pot and withdraw it hastily, as if it were hot.

John Brookshaw, foreman over the pipe-layers, in the employment of the Manchester Corporation Gas Committee, who was cautioned by the coroner that his evidence might be used against him, said it was his business to see that the men did their duty in all respects. At the time of the explosion he had gone to look after another section of men. Previously he had been superintending the work where the accident happened. He gave Eachus no instructions whatever; he tested the pot in the way in which he had tested others. These pots were always tested on the spot, either on the surface or in the hole. Mr. Rafferty was his superior officer, but he gave him no instructions with respect to this pot.

By Mr. COBBETT: There were no special instructions in these cases; there was a practice, and that practice was followed.

By Mr. SHARP: There was no rope round the syphon to keep off the bystanders when he left the place prior to the explosion.

Mr. *Thomas Rafferty*, superintendent of the street main department (who was likewise cautioned by the deputy-coroner), said that these pots were first laid about 15 years ago, and they were then tested under his directions, as Eachus had tested the one in question. He could not recollect what directions were at that time given, but there were some printed directions, which were supplied to every foreman. The printed directions said that all pipes when laid must be fired, in order to ascertain whether there was any leakage, and the syphon pots came under this direction. Eachus was with him when the first large pots were tested, four or five years ago. He therefore knew what practice was followed, and no further orders were given to him. The same method had been pursued since. He considered Eachus to be a competent man. He thought it safe to apply fire to the syphon to test it when there was a connection between the syphon and the main. Supposing a light had been left at the top of the pot when the disconnexion was effected, he was of opinion that an explosion would have resulted. He accounted for the explosion by a supposition that some one had struck a match at the time the pipe was disconnected. If a match was struck four yards from the disconnexion he was of opinion that the explosion would have occurred.

DEPUTY-CORONER, in summing up the evidence, said it seemed clear that the torch was put out before the explosion took place, and that therefore there could be no connexion between the accident and the lighted rope. The jury had to consider, in the first place, whether they had any reasonable doubt as to how the explosion was caused. Was it caused by there being a light on the end of the pot; or by an escape of a mixture of gas and atmospheric air on coming to some naked light; or would they say that they were unable to come to any definite conclusion as to the cause of the accident. It was Eachus's duty to fill the pot with pure gas, and if it had been so filled the explosion could not have occurred. Mr. Leigh had told them that Eachus had used the only means within his reach to ascertain whether the pot was full of pure gas or not, and it was for the jury to consider how far blame ought to be imputed to him. It did not appear to him that Eachus had been guilty of criminal negligence in not filling the pot with pure gas. If the jury found that the explosion occurred through a light being left on the top of the syphon, then Eachus was responsible for the light. It seemed to him that Rafferty was responsible for the present mode of testing, and he had been guilty of negligence, not, however, of criminal negligence.

The jury, after a long consultation, returned a verdict that the deceased were killed by an explosion of gas, which occurred owing to the negligent or lax manner of testing the syphon by the gas officials; and they were of opinion that the superintendent (Mr. Rafferty) ought to have been present to conduct the testing; and that the people ought to have been better protected.

The CORONER: Then you are unable to say how the accident happened?

The FOREMAN: Quite so.

The CORONER: What do you mean by saying the people ought to be protected? Do you mean by a better method of testing?

A JUROR: Yes, and by keeping them farther off.

The proceedings then terminated.

ON SOME RECENT PROCESSES FOR THE MANUFACTURE OF GAS FOR ILLUMINATING PURPOSES.

By T. WILLS, F.C.S.

SOCIETY OF ARTS, ADELPHI—WEDNESDAY, MAY 21.

During the last two years various causes have combined to make the time a very favourable one for the introduction of new schemes for the manufacture of gas. Amongst these causes the following may be mentioned:—First, the fear (although to a great extent, perhaps, groundless, yet nevertheless frequently expressed) that our supply of coal will be gradually lessening, and that, at no very distant date, it will become so curtailed as to increase its value to a formidable extent; second, the tendency of the coal market to push the price of coal up to an extent out of all proportion to the necessity, has also created uneasiness; and third, partly in consequence of this, although it must also be said partly on account of a wide-spread suspicion of mismanagement, gas companies have avowedly been occupying lately, an exceedingly difficult position (a position immediately recognized and very soon taken advantage of by their *employés*), with no great prospect which could inspire hope for the future. Again, the great prosperity of the country and the free circulation of money, coupled with a comparatively small number of safe and lucrative investments, have to a great degree been the motive power of many schemes which, without their aid, would have had considerable difficulty in fighting their way into public notice. There is one other cause lending its tendency in this direction, which, though perhaps entertained only by a few, is yet continually growing in importance, and that is the belief that the present mode of gas manufacture is wasteful and unscientific, and only at the best a poor method of obtaining the desired result. To those who have not realized this fact it is only necessary to point to the very small amount of the hydrogen and carbon contained in the coal which find their way into the gas; to the large number of bye products obtained in the process—bye products which, it must be remembered, although themselves valuable and daily increasing in value, are produced and disposed of only because at present it is impossible to prevent their formation, and which should consequently occupy quite a secondary position; and to the existing imperfections in the apparatus used in the purification, storeage, and distribution of the principal product.

The present paper takes into consideration two or three of the most important of these new processes. It is intended to examine them by the light of scientific facts, and to say very little about the commercial merits or demerits of any particular scheme or schemes, although it cannot be overlooked that the one has a very important bearing upon the other. To do even this satisfactorily it will be necessary to review briefly the chemical and physical laws which are called into operation in the manufacture of gas, and also to give a short description of the apparatus at present employed for this purpose.

The organic origin of coal is at this time an undisputed fact, and we recognize in the black carbonaceous mineral the decayed and partially decomposed remains of a luxurious tropical vegetation—a vegetation as far excelling, in extent and rapidity of growth, the present growth of the tropics as that does the more moderate growth of the temperate regions. This being so, in order to arrive at a correct knowledge of the nature and constitution of coal we must go back to the stems, tissues, and foliage of the plants and trees, the growth and death of which has given us our coal measures.

The number of elements entering into the constitution of such vegetation is exceedingly limited—at the most four—yet the arrangement of these four is so complex that it is at times impossible to perceive in what manner they are united. This complexity of arrangement is peculiar to organic compounds, and as a rule stamps them as being the products of some vital energy or force.

Woody fibre—viz., that part of the plant or tree which gives to it its form and shape—we know contains the elements carbon, hydrogen, and oxygen, and we also know the amount of each which enters into its constitution, but the exact manner in which the three are united to each other is unknown. Now, when any complex organic body is left to itself to decay—in other words, to become oxidized—the tendency is for it to resolve itself into simpler compounds; and if the decomposition goes on to completion, the carbon and hydrogen will each unite with oxygen to form the most stable compound which they possibly can with that body—viz., in the case of carbon, carbonic acid ($C O_2$), and of hydrogen, water (H_2O). If the fermentation or decay be arrested at some intermediate stage, then compounds will be formed less complicated than the original woody fibre, but still more or less removed from the final result, according to the stage at which the action was stopped. The decomposition of this woody fibre has proceeded to a considerable extent in coal, a portion of the carbon and a large portion of the hydrogen having gone off in the form of marsh gas (fire-damp), and a further portion of carbon, together with the oxygen, as carbonic acid, while a third portion of carbon has been separated in its elementary state. We are able to trace this action through several stages, which will be more distinctly seen from the following table, in which the amount of carbon is kept up to 100 in the several carbonaceous materials:—

	Carbon.	Hydrogen.	Oxygen.
Wood	100	12·18	83·07
Peat	100	9·85	55·67
Lignite	100	8·37	42·42
Bituminous coal	100	6·12	21·23
Anthracite	100	2·84	1·74

Here not only are we able clearly to trace by the analysis of these substances the changes through which they have passed, and are passing, but their physical appearance and structure fully confirms this evidence. Thus in peat the structure of woody fibre is recognizable at a glance; in lignite and bituminous coals this structure is not so clear, but still unmistakeable; while in anthracite or stone coal nearly all trace of it is gone. This slow decomposition or fermentation may be regarded as a slow burning or combustion—viz, a union of the matter of the wood or coal with oxygen, and it is attended with the same result.

If instead of slow fermentation and decay of the wood into coal taking place the wood had been burned at once, practically the same result would have been obtained; the elements of the wood would seek to place themselves in a much simpler relationship to each other, the various changes would have been gone through more rapidly, but the final result would be identical with that of the previous case—viz., the production of water and carbonic acid. Here also there are many intermediate stages. Combustible gases are formed in abundance, together with tarry and oily matters, composed of carbon and hydrogen, and it is only by the further burning of these that the complete decomposition is obtained. What is true here of wood is also true of coal itself, if it be taken as the starting point, more particularly, however, of those coals which still contain a fair proportion of hydrogen and oxygen.

In each case the more intense the heat, the more rapidly does the decomposition proceed, or, in other words, the quicker does the combustion take place. Further, the more complicated the structure of any particular substance the more readily will it be split up by the action of heat, provided that its constituents can exist in a number of simpler states, which in carbon compounds and organic substances is invariably the case. In the above instances it is supposed that the wood or coal is heated in air, but it is evident that we may prevent the access of air to the heated material, and, by so doing, we can arrest the decomposition of such material before the final stage of decomposition, as the only oxygen present will be that given off from the substance, which will in either case be insufficient for the complete combustion of the carbon and hydrogen. If the substances be heated under such circumstances, a number of compounds of carbon and hydrogen will be formed, simpler than the original wood or coal, but still having a considerable complexity of constitution.

This resolution of complex bodies to simple forms, under the influence of heat, out of contact with air, is termed destructive distillation, and is the process invariably employed in the manufacture of gas directly from coal. Thus it will be seen that the possibility of making such gas depends in the first place upon two things:—

1st. The great complexity of organic bodies, especially vegetable matter, and consequently coal.

2nd. The power which the elements constituting such substances possess of forming a number of simpler bodies (some of them gaseous) when heated out of contact with air.

Although it is perfectly true that we cannot, in the process of destructive distillation, burn up our carbon and hydrogen into carbonic acid and water, for the want of the necessary oxygen, yet we may even go further than this, and reduce the carbon and hydrogen to their elementary condition, if the heat be only sufficiently intense; and it may be mentioned here that the reason why the experience of gas engineers has always shown that a higher temperature gives a greater yield of gas per ton of coal, but gas of lower illuminating value, is to be found in this tendency of the carbon and hydrogen gradually to resolve themselves, under the influence of heat, into simpler and yet simpler products, until eventually a temperature is reached at which the greater portion of the carbon is deposited, and the hydrogen goes off in its elementary gaseous state.

The following table, in which the proportion of hydrogen is maintained at 100, illustrates this point:—

Table showing the Proportion of Hydrogen and Carbon in Coal Gas Distilled at Different Temperatures.

Temperature.	Hydrogen.	Carbon.	Name of Gas.
Dull red heat	100	614	Principally olefiant gas (C_2H_4).
Red heat	100	580	
Bright red heat	100	472	Olefiant gas (C_2H_4) mixed with marsh gas ($C H_4$).
White heat	100	325	Marsh gas ($C H_4$).
Continued white heat	100	7	Nearly pure hydrogen, carbon deposited.

The number of well-known intermediate products obtained during the destructive distillation of coal is very large, and it is extremely probable that there are many that have as yet escaped observation. The subjoined table enumerates the principal of these products, as well as the physical condition in which they exist at ordinary temperatures. It seems scarcely necessary to say here that these are true products, and in no wise educts—that is to say, they had no previous existence in the coal.

Gaseous.

Hydrogen	Butylene
Marsh gas	Carbonic oxide
Acetylene	Carbonic acid
Olefiant gas	Nitrogen
Propylene	Ammonia

Liquid.	
Water	Cymol
Benzole	Aniline
Toluole	Picoline
Cumol	Bisulphide of carbon
Solid.	
Paraffin	Pyrene
Naphthalin	Chrysene
Paranaphthalin	

These products are here represented as isolated and existing by themselves, but, in reality, they are found mechanically mixed in the rough materials obtained during gas distillation; practically, the result of this distillation consists of only four products:—1st. The coke, which remains upon the bed of the retort in which the coal is carbonized; 2nd. A light, watery fluid, which contains some of the more soluble gaseous substances dissolved in water; 3rd. A pitchy or tarry substance formed of the liquid and solid products, the lighter portion of which contains the liquid oils and naphtha; and finally, the gaseous bodies, together with which is always found more or less of the vapours of the more volatile liquids.

As the hydrocarbons become richer in carbon, and proportionately poorer in hydrogen, the tendency is for the substance to assume the liquid state; and if this excess continues to increase, eventually to become solid. Thus, olefiant gas is C_2H_4; benzole (a liquid), C_6H_6; while naphthalin (solid) is $C_{10}H_8$.

It is advisable here that we should look a little more closely into the physical condition of some of these bodies, as upon this depends the success or want of success which attends many of the new schemes.

The solid, liquid, and gaseous states of matter are not divided from each other by any sharp line of division, but gradually pass from one to the other by insensible gradations; this is evident to us in the case of solids and liquids, for we are acquainted with many bodies which cannot fairly be placed in either class, and to which the term viscous may appropriately be applied; not so evident, but still observable, is a state of matter bearing a relation to the liquid and gaseous states, such as viscous bodies do to liquids and solids; and, from such and other evidence, we regard gases as being the vapours of liquid bodies, more or less removed from the boiling points of such bodies.

A perfect gas would be defined as possessing the condition of perfect fluid elasticity, and presenting under a constant pressure a uniform rate of expansion for equal increments of heat, but it seems probable that this theoretical definition is never absolutely realized, for although we still speak of a few gases as perfect, and represent them therefore as fulfilling the above law, yet all analogy and previous experience would indicate that eventually even this statement will have to be modified. The term vapour was, for a long period, a term for a distinct class of gaseous substances—viz., those which could be made to assume the liquid condition; but, by the investigation of many experimenters, led by Faraday, this point is at present only a question of the adequateness of the means employed, and hence this term may now be used in a much wider sense, and may include all gases whatsoever, for that these are but the vapours of liquids possessing exceedingly low boiling points appears to be distinctly proved. All liquids whatever, at all temperatures, give off certain quantities of vapour from their surfaces; the amount thus given off differing for different bodies and for different temperatures; if the liquid be enclosed in any vessel, the vapour will exert a certain pressure upon the sides of such vessel, and this pressure will vary with the temperature, being higher for higher temperatures, and lower for lower ones. This pressure is termed the tension of the vapour of that particular substance. This may be readily illustrated in the following manner:—If a small quantity of water be passed up into the vacuum existing at the top of an ordinary barometer, the mercurial column will immediately be depressed to a certain extent, which depression will be due to the vapour given off from the water at the particular temperature at which the observation is made, and its amount will represent the vapour tension of water. Now, if alcohol be used in a similar experiment, the depression will be much greater, and hence the vapour tension of alcohol is greater than that of water, and so on, every liquid giving a different result.

Now, if we take a case in which the amount of liquid passed to the top of the mercurial column is insufficient for the formation of that amount of vapour which the given space can take up, the whole of the liquid will then disappear, and the depression will appear to be due to the presence of a quantity of true gas, and this is borne out by the fact that a vapour in this state—unsaturated, as it is called—follows all the laws that the more permanent gases do. It will be found, for example, to vary in volume directly as the pressure, and further to increase or decrease in volume at a uniform rate on an increase or decrease of temperature. But now, on the other hand, let more of the liquid be passed up into the vacuous space than can possibly be required to fill it with vapour; in this case a quantity of the liquid will remain upon the surface of the mercury, and the superincumbent vapour is then said to be saturated, which indicates that as much vapour as can exist at that particular temperature will be found so existing in the given space; if, therefore, the temperature be now raised, a further quantity of the liquid will be converted into the gaseous condition; if lowered, a portion of the liquid already existing as gas will return to the liquid state; in the same way, if the pressure be lowered or raised, the same result will be observable. Thus it is seen that the vapour proceeding from every liquid substance possesses a fixed maximum tension for every particular temperature or pressure, which it cannot exceed under any circumstances.

It follows, also, that if we take the case of an unsaturated vapour, by either increasing the pressure or reducing the temperature, we shall eventually reach this point of maximum tension or saturation, after which any further increase of pressure or decrease of temperature will be attended with a condensation of the vapour into the liquid state; and, in fact, it has been by using either one of these processes, or both combined, that nearly the whole of the bodies existing as gases have been liquefied. Another point must be mentioned here. In the above illustrations the various liquids were supposed to be passed up into a vacuum, the vacuum existing above the mercury, in an ordinary barometer. Now, precisely the same results would have been obtained if this vacuous space had been filled by any gaseous body; the quantity of vapour given off by a liquid is absolutely independent of the medium into which it is so given off.

The importance of some of these facts, as regards the manufacture of gas for illuminating purposes, will be seen when it is considered that coal gas not only contains certain permanent gases, but also a large quantity of the vapours of volatile hydrocarbons, which contribute in no small degree to its luminosity; and these points will be referred to again, more particularly when speaking of carburetting air or gas.

A few words are necessary here to state a few facts regarding the luminosity of the flame of gaseous hydrocarbons.

It is still generally accepted that the luminosity of flame is due to the presence of intensely heated solid particles (although some powerful objections have been urged against such a belief). In the case of the combustion of all hydrocarbons, these solid particles are particles of carbon.

Now, a flame will be more or less luminous according to the greater or less number of such particles present, and to the temperature to which they are raised. The denser the hydrocarbon, the greater number of carbon particles will exist in a given space, and when its vapour is burned, there will be a correspondingly greater number precipitated into the interior of a flame. Now, bearing these two points in mind, it will be manifestly advantageous to obtain for combustion such compounds of carbon and hydrogen in that proportion of the two which shall give us the greatest quantity of carbon to the smallest quantity of hydrogen, provided that the heat of the flame is maintained sufficiently high to raise the carbon particles to whiteness. This latter condition is quite as important as the former, for it is quite possible that a gas containing a considerable amount of the denser hydrocarbons shall, by reason of the comparatively low temperature of its flame, possess less illuminating power than a gas possessing a smaller quantity of such hydrocarbons, the temperature of the flame of which, however, is somewhat higher. It would appear to follow from this, that every effort ought to be made by the gas-maker to obtain a gas containing as large a proportion as possible of these more luminous compounds; but a glance at the following table, containing analyses of the gas supplied by several different companies, will show that, at any rate, this effort, if made, is not very successful, the greater bulk of the gas being composed of hydrogen, the flame of which is without any light-giving properties whatever, and marsh gas, a gas possessing the least light-giving power of any hydrocarbon, as it contains the smallest proportion of carbon to the largest of hydrogen.

Composition of Coal Gas supplied by the following Companies:—

	Great Central.	Imperial.	Chartered.
Illuminating hydrocarbons	3·56	3·67	3·53
Marsh gas	35·28	40·66	35·26
Hydrogen	51·24	41·15	51·80
Carbonic oxide	7·40	8·02	8·95
Carbonic acid	0·28	0·29	—
Nitrogen	1·80	5·01	0·38
Oxygen	0·44	1·20	0·08
	100·00	100·00	100·00

The result, as stated here, is even more unfavourable than it at first appears, for the above figures, representing the quantity of illuminating hydrocarbons, express not only those that are really gaseous bodies, but also the vapours of liquids held dissolved in the gas. There can be no question that a great advance in the manufacture of coal gas would be made, if by any means applied either to the primary distillation of the coal or to the gas after its production, whereby the amount of acetylene (C_2H_2) or of olefiant gas (C_2H_4) could be increased; for olefiant gas contains, in a given bulk, just twice as much carbon as marsh gas, and acetylene a still larger quantity. The value of this increase is not to be measured only by the increased quantity of carbon contained in a given bulk of gas, for a small portion of either of the above compounds, diffused through a non-illuminating gas, is much more than equivalent to a similar quantity of carbon combined in some less condensed compound. An illustration of this occurs in the case of marsh gas. If marsh gas, possessing, it will be remembered, only a small amount of luminosity, be decomposed, either by its passage through a heated tube, or by the electric spark, the carbon it contains will be deposited, while the amount of hydrogen set free will occupy double the volume of the original gas. Yet the flame of this nearly pure hydrogen will be found to possess a greater luminosity than the flame of the original marsh gas, although it has lost nearly the whole of its light-giving material, accounted for by the presence of a very small quantity of acetylene, produced during the decomposition. The light of a coal gas flame is, without doubt, somewhat increased in a similar manner, for the reason that during the precipitation into the interior of the flame of the solid hydrocarbons—viz., during the decomposition, under the influence of the high temperature of the flame, of the gaseous bodies—small quantities of very much more highly condensed substances are formed, substances which probably would exist in the solid state if isolated at ordinary temperatures. Further than this, coal gas, although practically a gaseous body at all temperatures, does, as has been said, act as a vehicle for holding in suspension, and carrying, a certain quantity of the vapours of such bodies as benzole, toluole, naphthalin, &c., which are to be found in the tar, with what practical success—success which is sufficiently certain as to be relied upon—we shall have to consider when speaking of the special carburation of gaseous bodies as a means of obtaining illuminating gas. It is, indeed, for this purpose that these remarks regarding the luminosity of flame have been introduced.

As there are three schemes, to which reference will be made, for the manufacture of gas, which deal with modifications of the existing apparatus employed, it will be desirable to give a general statement of that which is at present almost exclusively used.

The coal to be distilled is exposed, in quantities of about five hundredweight at a time, to a comparatively high heat—a bright cherry-red heat is usually employed—in elongated tubular vessels of earthenware or iron, called "retorts," the shape of which varies slightly, some being that of a capital D, with its perpendicular stroke placed as a base, others circular, and others elliptical; 10 feet long, 20 inches wide, and 14 inches high, are about the proportional measurements. A number of such retorts are usually set in a furnace, and heated by one fire; in most large works double retorts are used, which are worked from both ends, as if they were two single ones. At the mouth, or mouths, is a flange, upon which a plate of metal—the lid—is capable of being secured strongly, and made tight with luting, if necessary; through these mouths the coal is introduced by means of long scoops or gutters, and the coke at the close of the operation withdrawn by the aid of rakes. Immediately upon the introduction of a charge of coal into a heated retort carbonization commences, and gas is evolved. This carbonization occurs first with that portion of the coal which lies in contact with the sides and bed of the retort, and hence is more complete than that of the interior, which, however, undergoes destructive distillation, and furnishes gases and vapours of higher hydrocarbons. These coming into contact with the heated mass on the exterior split up into simpler bodies, the great desideratum being to heat the coal to an equal extent all through at the same time. The gas is conducted from the retorts by perpendicular pipes, about 5 inches in diameter, which rise near the mouth, called stand-pipes; these pipes, which taper towards their upper extremities, are above the furnace bent twice at a right angle, and enter a larger pipe running horizontally over the centre of the retorts. This tube, which is called the "hydraulic main," is at all times half full of tar and oil, and the ends of the bent tubes are allowed to dip into this tar to the depth of 2 or 3 inches, for the purpose of cutting off all communication between the retort and the gas which has left it. This hydraulic main is fixed horizontally, the tar being drawn off from its extremities, and as the whole length of tube is kept at a fair heat—which heat should not be too strong—by reason of its contiguity to the furnace, the tar is usually in a liquid condition. It becomes essential that the gas should be submitted to a process of cooling, in order that those more condensible bodies which have been vaporized by the great heat may be deposited, owing to the great mobility of gaseous matter, and its possessing a high latent heat, this process becomes one of some little difficulty, and necessitates the exposure of the gas to a very large cooling surface. This is attained either by simply passing the gas through iron tubes of sufficient length, or through hollow iron columns, having an annular closed space through which the gas circulates. The extent of surface needed is sometimes very large, as much as ten square feet of cooling surface being often necessary for every cubic foot of gas passing per minute. If it were left for the evolution of the gas in the retorts to maintain a sufficient pressure to drive it through the various apparatus, considerable loss would result from leakage; and it is found further that the gas produced under pressure is not so good in illuminating power, a considerably greater quantity of carbon being deposited under such circumstances. Hence it is customary to employ what is called an exhauster, this being usually a rotary fan, acting the part of a rough air-pump. The use of this apparatus places the pressure entirely under

control, and allows it to be reduced at the retorts to about half an inch of water.

After the gas leaves the condenser, it has to be submitted to the various processes of purification; but as these do not in any way bear upon the present subject, it will be sufficient to state that it is first washed or *scrubbed* by passage through a coke tower, over which water is allowed to trickle, to remove any residue of tar and also the ammonia which it contains. Thence it passes into a tank of milk or cream of lime, kept in continuous motion, for the removal of carbonic acid and sulphuretted hydrogen, and lastly through a series of trays filled with dry lime and oxide of iron, for the removal of the residual sulphur existing in the form of sulphuretted hydrogen or bisulphide of carbon. The gas is then stored and distributed.

It was mentioned in an earlier portion of this paper, that if coal be distilled at a high temperature, a very large yield of gas can be obtained; this increased yield, however, will be coupled with a considerable diminution of illuminating power. The reason for this was then explained—in fact, the distillation of coal may be carried on at such a low temperature that the quantity of gas obtained is practically nothing, the whole of the products appearing in the solid or liquid state (a *prolonged* exposure of gaseous hydrocarbons to a low or even moderately high heat is attended with precisely similar results—viz., the formation of more complex substances), or conversely the heat may be so high as to completely decompose the whole of the hydrocarbons into their constituent elements. It is found advisable, in ordinary working, to take a mean of these results, and thus a fair yield of gas is obtained, together with a not inconsiderable amount of tar and oily matter. These latter products increase in direct proportion to a decrease of temperature, and a consequent decrease of gas, thus:—

Table of Amount of Gas and Tar obtained at Different Temperatures.

Temperature of Distillation.	Amount of Gas Obtained.	Amount of Tar.
		lbs.
Very low red heat.	7500 ..	150
1300 deg. to 1400 deg. Fahr.	8300 ..	120
Bright red heat	9500 ..	70

There are three considerations which influence a gas engineer with regard to the temperature at which he shall distil the coal, and which sometimes compel him to use a heat higher than would otherwise be advantageous; these are, first, the time which can be afforded for the production of a given quantity of gas—a lower temperature means a more or less lengthened time of exposure for the same quantity of coal, and where, as is usual, the necessary plant is only just sufficient for the supply of the required quantity of gas, this prolongation of the process is impossible; second, the per centage of fuel (coke) used in the furnaces for the distillation; this is likely to be greater for a greater interval of time; and, thirdly, the quality of the coke produced, for the demand for coke, and consequently its value, is great, and it is therefore the principal bye-product in the gas manufacture, and its production in fair quantity, and of good quality, becomes an important point in the economy of gas-making.

In 1871, a patent was taken out for "Improvements in the manufacture and purification of gas, and in certain parts of the apparatus employed therein," which, while mainly dependent upon the distillation of coal and other bodies at low temperatures, proposed to fulfil all that could be desired with regard to the second and third of the above considerations, and at the same time offered, in compensation for the prolonged time occupied by the distillation, a very considerably increased yield of gas of a much higher than usual illuminating power. This process is carried out by distilling the coal at a much lower temperature than usual—in the original scheme from 600 to 1000 deg. Fahr. is mentioned, but, in practice, from 1300 to 1400 deg. Fahr. will probably be employed. At this temperature, from a ton of gas coal, about 8500 cubic feet of gas are obtained, together with a greater than ordinary yield of tar and oil. This tar is condensed by special means employed for securing a greater rapidity in the process, and collected as free from water as possible, with a view to its being redistilled in a separate and peculiar retort. The gas produced during the carbonization of the coal is, as may be expected, a rich gas of high illuminating power; and, after its production, it is in all respects treated in the ordinary manner, and will therefore not require further special mention, unless it be in one particular, and that is its comparative freedom from what has been called the *residual* sulphur impurity. As this sulphur impurity consists almost entirely of the volatile bisulphide of carbon, which is recognized as a product of high temperatures, the occurrence of only a small portion of that body in gas distilled at as low a temperature as that used in this process is in no wise strange, although, doubtless, at the same time, it is a favourable result. The special point of this invention consists in the submission of the oil and tar collected to separate destructive distillation at a low heat, whereby a certain quantity of those substances is vaporized, attended at the same time with the formation of another quantity of condensible products. These products are again distilled with a further partial decomposition, and this process is repeated until a given quantity of tar has been converted into vapour, and a certain amount of pitch. The means used for obtaining this result are as follows:—The tar and oil are allowed to flow into an iron pan, maintained at a temperature of about 700 or 800 deg. Fahr. In this apparatus the more volatile constituents are rapidly evaporated, and are conveyed into a hollow iron tank for the purpose of retaining any of the material mechanically carried over, thence through a retort filled with charcoal in small pieces, and heated to a temperature of about 1000 deg. Fahr.; by the passage of the various vapours through this vessel they no doubt suffer decomposition, not brought about by any property of the ignited charcoal, but doubtless by the more thorough heating of the gas, the very large heating surface afforded by charcoal successfully bringing the particles of vaporous matter up to a sufficiently high temperature for decomposition; in this manner a quantity of gaseous matter is formed, notably hydrogen, carbonic acid, carbonic oxide (the oxygen being obtained by the splitting up of what water there is present), marsh gas, and a small quantity of illuminating hydrocarbons; the condensible products are treated again in the same manner as before mentioned. The gas obtained from the oil and tar is treated in the ordinary manner as regards purification, and is ultimately mixed with the gas originally obtained from the coal. The aggregate quantity thus produced is declared to be in excess of that usually obtainable from an equal quantity of coal, and possesses a considerably greater illuminating value.

This is the most recent of many processes for the distillation of coal tar and oil. Hitherto it has been found most economical to distil the substance from which gas is to be manufactured at once, that is, having only one stage in the process, for previous experience has shown that the production of a quantity of intermediate products, and their after distillation, has always been a wasteful mode of working, both as regards the result obtained and the expenditure of power and material in order to obtain it.

This new process has been submitted to the investigation of two eminent independent scientific men, both having a large acquaintance with the various processes of gas manufacture. The value of such investigation cannot well be over-estimated, and it would appear desirable that in all such cases similar investigations should be resorted to, for it rarely happens that an inventor is able to perceive the weak points of his own invention, and still more rarely is he able to grapple with and surmount them by the use of his own scientific knowledge, while at the same time it is not too much to say that many processes and schemes have been allowed to dwindle and die because the good and useful points which they contained have not been perceived amongst so many erroneous views and ideas. A searching and clear examination of any particular invention ought to be regarded as exceedingly valuable testimony.

The following are some of the more important points brought out by the examination of the above described process by Messrs. Keates and Odling. The experiments conducted by these gentlemen were made upon two scales, the first a manufacturing one, in which the process was in use for the manufacture of gas for the public consumption; and the second upon a much smaller one, in which, however, the various apparatus was necessarily under more perfect control, and hence some points were capable of clearer elucidation. The highest yield of gas obtained directly from the coal was 9775 cubic feet, the temperature of distillation being between 1300 deg. and 1400 deg. Fahr. The quantity of oil and tar obtained from one ton of coal varied considerably with the nature of the coal used; thus, Silkstone coal gave 16·4 gallons of tar and oil per ton; Clay Cross Main, 11·9 gallons; and Pelaw Main, 13·9 gallons, or a mean of 14 gallons. The highest yield of gas which was obtained by the continued distillation and redistillation of the oily tar was 29 cubic feet per gallon. The mean lighting power of the gas produced from coal was 23·0 candles, and of that obtained from the tar 25·0 candles. The quantity of coke used to maintain the heat in the various parts of the apparatus was about 33 per cent. of that produced, and in the event of the distillation being repeated until complete separation into pitch and vaporizable matters takes place, this amount would be much exceeded. It must also be remembered that the time occupied in the distillation of the coal is just double that allowed when ordinary high heats are employed. The most successful experiment as yet made with this process has shown that from one ton of coal it is possible to produce 9500 cubic feet of 23-candle gas by a careful regulation of the temperature, and from 14 gallons of oil (the mean produce of one ton of coal) 600 cubic feet of gas of an illuminating power equal to 25 candles. Against this result must be placed the considerably increased time occupied for the distillation, and the increased consumption of fuel. It would appear, therefore, from these figures that the second process of distilling the oil is of very little practical utility. The expense attending the production of an equal quantity of gas of a scarcely less illuminating power from coal being far less than that attending the distillation of the oil or tar. Indeed the experimenters themselves consider that the oil would be more valuable as a marketable article than as a material for the manufacture of gas. That this process is capable of yielding a larger amount of gas of high illuminating power, and of a character as permanent as that of gas ordinarily produced from cannel coal, is, without doubt, satisfactorily proved; and the one point for the entertainment of gas engineers seems to be the relative simplicity and economy of producing coal gas of a high illuminating power in the ordinary way by the distillation of a rich, and consequently more expensive coal, or of the adoption of this process of distilling an ordinary gas coal at a low heat, with a correspondingly longer exposure.

Another arrangement has been patented which, to some extent, embodies the above idea, although with some considerable modifications; thus the processes of distillation and redistillation are carried on simultaneously. The two heated tanks for the heating of the tar and oil of the previous invention are dispensed with, and heated iron pipes, in reality continuations of the retorts, placed parallel with them, and heated by the same fire, filled with some porous material, such as pumice or coke, are substituted. The tar formed, which is not so large in amount as that obtained in the ordinary manner, is thus further decomposed by its passage over the large heated surface, and the gas so produced helps to increase the ordinary yield. If coke be used for the porous material, it speedily becomes converted into a pitchy cinder in appearance, almost identical with the charcoal after its exposure in the previous process, and forms a very fair fuel for the heating fires. There is, however, a difference in this invention, which, although not claimed as part of the patent, yet forms an important point in it, and this is that a jet of superheated steam is driven into the retort, and brought into contact with the heated coal. During the carbonization a portion of this steam undergoes decomposition in the presence of the red-hot coal; its oxygen uniting with the carbon to form carbonic oxide, and its hydrogen being liberated as gas, it was expected that this hydrogen would also unite with a portion of carbon to form some gaseous hydrocarbon, but this is not possible, as the highest temperature attainable in a retort of this description would be far too low to bring about such a direct union, but an indirect benefit may arise from this injection of steam, and that is, that the gases formed from the coal may be more quickly removed from the heated mass, and being at the same time somewhat diluted, the tendency to form more complex bodies will be partially destroyed, and consequently the production of the tar and oil will proportionately cease. The previous heating of the steam is no doubt necessary in order to prevent undue condensation, but its being heated to redness, as mentioned in the specification, would prove a difficult and probably unprofitable operation, and would certainly be impossible to accomplish by merely bringing it into contact with the heated sides of the retort. The result of introducing a jet of steam into the retort during the making of the gas may be said to have been successful to the extent to which it has been tried, but the amount so introduced requires very careful regulation. A very full and complete trial was made by a number of eminent men some years ago upon a plan very nearly allied to this—viz., what was known by the name of "White's hydrocarbon process," in which steam was introduced into the retort with the heated coal, and the following points appear to have been satisfactorily proved:—

1. An increase in the produce of gas from a given weight of coal was obtained.
2. An increase in the illuminating power of the gas afforded by a given weight of coal.
3. The amount of tar and other oily products is considerably diminished.

It is a generally accepted fact that the quicker coal be carbonized in gas-making, provided it be done effectually, the more successful will be the operation. In the ordinary process this end is far from being reached, the carbonization gradually proceeding from the exterior layer of coal directly in contact with the heated bed and sides of the retort towards the centre and more protected portions; and as a consequence of this, the heavier and more condensed, and in some respects more valuable gases, coming from the interior part of the fuel, have to pass over the more thoroughly carbonized and hotter outer portion, and will thus suffer a further decomposition before leaving the retort. Many plans have at various times been adopted to obviate this evil, such as exposing the coal in exceedingly thin layers, or forming the bed of the retort of a constantly moving stage, upon which a thin layer of coal in small pieces is constantly exposed to a uniform heat. Some of these methods have been successful, but have had in most cases to be abandoned on account of greater complication of machinery, and hence greater difficulty in continuous working. A plan—probably the simplest that has yet been introduced—has recently been brought forward, the principle of which is as follows:—The retort in this case is set in a vertical position, and through its centre revolves a broad and somewhat deep screw, put together in sections, the thread of which is placed at an angle of 45 deg., and which comes nearly into contact with the sides of the retort. Through a hopper at the top coal is supplied in pieces of small, but regular size. The inclination of the thread of the screw impels these pieces against the heated sides, where comparatively rapid carbonization takes place, and the rate of revolution of the screw is so regulated that by the time the fuel has arrived at the bottom of the retort the process is complete, and coke of a somewhat inferior quality is discharged into a suitable receptable. The yield of gas is greater by this means and of higher illuminating power, the amount of tar being correspondingly less. The difficulties encountered appear, as in previous methods, to be chiefly mechanical, the great friction to be overcome by the working of the screw requiring considerable power, the wear and tear thus becoming also greater. Further, the exposure of the iron to such a

continuous high temperature renders it extremely brittle, a quality enhanced, no doubt, by the presence of sulphur, which causes a superficial conversion of the iron into sulphide. That the process itself is to a great degree successful will be seen from the following results:—

Coal Carbonized.	Quantity of Gas obtained.	Illuminating Power of Gas.	Amount of Tar.
1 ton	11,040	16 candles	8·5 gallons.
1 ton	10,160	17 candles	—
1 ton	12,000	16 candles	—

The fact of the existence of a large number of hydrocarbons of great volatility, the vapours of which, when ignited, burn with exceedingly luminous flames, has been a very great incentive with inventors to produce some scheme whereby these vapours might be used to confer luminosity upon a combustible non-luminous gas, or further, inflammability, coupled with luminosity, upon a non-combustible and negative gas. The Patent Office contains the record of many such schemes, which, for some reason or other, have failed to fulfil their originators hopes and desires. Much misapprehension has arisen upon this matter. Too much has often been expected from such schemes; but, on the other hand, a large amount of unreasonable contempt has been poured out upon all projects of the kind, both extremes being avoidable by a short consideration of certain well-known physical laws. It should be remembered by the opposers of the possibility of there being any good in such ideas that to a great extent, larger than is generally thought, the luminosity of coal gas itself is dependent upon the presence of the vapours of such volatile substances, which are held in a state of solution in the gas, but which still remain condensible bodies; and we shall see presently that the loss in illuminating power which coal gas undergoes on exposure to a low temperature, is really due to the condensation of such substances. These remarks apply to the principle of carburation, and not to any special means of applying that principle.

This idea of carburation is not by any means new, having been started almost at the same period that lighting by coal gas in the ordinary way was introduced; but it was not until the opening up and working of the American oil wells, by which a supply of very light pretroleum oil or spirit was obtainable, that any scheme in this direction was found to have any chance of success. In 1862 a patent was taken out in France by a M. Mongruel, which proposed to pass air through an exceedingly light and inflammable spirit, the air thus becoming charged with a certain amount of a highly luminous hydrocarbon vapour, in such a quantity as to render the mixture inflammable, and to allow of its being burned as an ordinary combustible gas. This idea was introduced into England by a company known as the Photogenic Gas Company, which received some amount of support at the time, but, from some cause or other, did not prove a success.

The various inventions brought into notice since that time for the purpose of carburetting air and other gases have been based upon precisely the same principle, but have differed considerably in the apparatus employed. A general distinction may be made here—more for the sake of separate examination than from there being any fundamental difference between them—between those processes which propose to use air as the vehicle or medium for holding in solution the hydrocarbon vapour, and those in which a combustible but non-luminous gas acts in such a manner; in either case any remarks upon the quantity of vapour taken up, and its character when held in solution, will apply to both. Many erroneous statements have been made on this matter for the want of a little scientific knowledge; for instance, in some cases patentees themselves have declared that a union takes place, other than mechanical, between the gases of the air and the vapours of certain hydrocarbons, which results in the production of such gases as olefiant gas,or acetylene, an utter absurdity and impossibility which would be evident to any who would consider under what circumstances, and under what circumstances only such gases are produced. A vapour of any hydrocarbon whatever will, whether it exist by itself or whether it be diffused through another gas or gases, always be such a vapour, and will invariably exhibit the properties characteristic of it; and, moreover, if diffused through a gas, will be found condensible once more to the liquid from which it was formed, if proper means be applied. An illustration occurs in the case of aqueous vapour, which always exists in greater or less quantity diffused through the air, but this vapour is still the vapour of water, exhibiting all its properties, and capable once more of assuming the liquid state on a sufficient reduction of temperature. Another view equally erroneous is, that a given bulk of air or gas will take up and hold in solution an almost indefinite quantity of vapour, and some extraordinary statements have been made as to the large amount of this quantity. Now, from what has been said in the earlier portion of this paper, it will be readily understood that this point is capable of experimental proof, and is not determined either by chance or accident. Every liquid body has a maximum tension of its vapour, and this point is as fixed for any particular substance as its specific gravity or its boiling point. If, therefore, a given space, filled either with air or other gas, contain a quantity of vapour at its maximum tension, that space will be saturated with such vapour, and it will be found impossible to cause it to hold ever so slight a quantity in excess of that already existing; as, however, this tension is lower for lower temperatures, a space that is saturated at a higher temperature will become over, or supersaturated as the temperature falls, and hence must deposit a quantity of vapour in the liquid state. When experiments are made with a view to test this result, the temperature of the *gas* should be the observed temperature and not the temperature of the vessel containing it, as the conducting power of a gas for heat is so bad that it takes a considerable time for any quantity of it to fall from a higher to a lower temperature. It will be seen, then, that the fixing of the maximum tension of the vapour from a liquid for different temperatures will give us an exceedingly good indication of the quantity of the vapour which may exist diffused through any space of air or other gas. A statement was made at the outset, which, for the sake of clearness, is repeated here—viz., that the medium in which the vapour is diffused has no effect whatever upon the quantity so diffused, a vacuum, or equal volumes of all gases, taking up the same quantity of the vapour of any liquid. The boiling point of a liquid is far more intimately connected with its vapour tension than its specific gravity; indeed, the boiling point depends upon the vapour tension, for when this tension equals in amount the pressure of the atmosphere, a body is said to boil, and does at that point enter into ebullition. A great tendency has been shown by inventors to reduce the specific gravity of the hydrocarbons which they use, with a view to obtain bodies of very great volatility, and to some extent the boiling points of such bodies have been disregarded. Probably this has not led them much astray, because, as it happens, the substances mostly used for these purposes, the light petroleum spirits, have low specific gravities and low boiling points, the two being reduced at the same time; but if almost any other class of hydrocarbons had been dealt with, the specific gravity would have proved no guide to the volatility of the compound; thus, in the case of the following bodies, alcohol, benzole, and bisulphide of carbon, which have respectively the specific gravities 0·719, 0·85, and 1·272, the vapour tensions, and consequently the boiling points, follow just the contrary order, and the body possessing the greatest density is really the most volatile. The vapour tension of alcohol, at ordinary temperatures, viz., about 15 deg. C., is equal to the depresion of the mercurial column to the extent of 30 mm, the vapour tension of benzole, in the same manner, is 55, and the boiling point of the liquid 78 deg. C., and of bisulphide of carbon as high as 250, with a boiling point of 48 deg. C.; low specific gravity is, therefore, not always coupled with low boiling point and great volatility.

A law was enunciated by Dalton, which, though since proved to be only approximately true, nevertheless enables us to obtain a rough idea of the vapour tension of any liquid if we know its boiling point, which was this:—"The vapours of different liquids have equal tensions at temperatures equally removed from their boiling points." Thus, the boiling point of alcohol being 79 deg., the vapour tension of alcohol at 50 deg. ought to be equal to the vapour tension of water (with a boiling point of 100 deg. C.) at 71 deg., which is approximately correct. Now, the boiling points of the light pretroleum spirits used in the carburation of air are pretty well known, and some of them are expressed in the following table, together with the specific gravity of the spirit:—

Boiling Points of Light Petroleum Spirit of Different Specific Gravity.

Specific Gravity.	Boiling Point.
0·600	4 deg. C.
0·628	30 ,,
0·669	68 ,,
0·699	92 ,,
0·726	118 ,,
0·741	136 ,,
0·757	160 ,,

The spirit more commonly employed has a specific gravity of about 0·650, having a boiling point of 58 deg. C. In the following short table the vapour tension of this spirit has been calculated by the above approximate law, for several different but often experienced temperatures:—

Table of Maximum Vapour Tension of Petroleum Spirit of a Sp. Gr. ·650 a Different Temperatures.

Temperature.		Vapour Tension.
—10 deg. C.	(14 deg. F.)	43·5 mm.
0 ,,	(32 ,,)	81·0 ,,
+10 ,,	(50 ,,)	132·0 ,,
15 ,,	(60 ,,)	167·0 ,,
20 ,,	(68 ,,)	203·0 ,,
40 ,,	(104 ,,)	301·8 ,,

These vapour tensions, therefore, express the maximum proportionate quantities of the spirit which can exist dissolved in air, or other medium, at those temperatures; thus the quantity of vapour dissolved at 15 deg. C. (60 deg. F.) or the temperature of a tolerably warm day, is just about double that which will be dissolved at 0 deg. C. (32 F.) or the freezing point of water; the reduction of the temperature from 15 deg. to 10 deg. C. (60 deg. to 50 deg. F.) is coupled with a loss of about one-quarter of the amount of hydrocarbon vapour. These points are capable of direct experimental proof, and all claims and statements made by inventors may be brought with perfect justness to such results. We may perhaps state the above table in a still clearer way, by converting the figures representing the vapour tensions into the per centage of vapour present in any bulk of gas at any particular temperature. It will then stand thus:—

Table of Per Centage of Vapour of Petroleum Spirit of a Sp. Gr. ·650, present in Air or other Medium at Different Temperatures.

Temperature.		Per Centage.
—10 deg. C.	(14 deg. F.)	5·7
0 ,,	(32 ,,)	10·7
+10 ,,	(50 ,,)	17·5
15 ,,	(60 ,,)	22·0
20 ,,	(68 ,,)	27·0
40 ,,	(104 ,,)	39·0

Now, for an "air gas" scheme to be successful, the air must hold in solution a sufficient quantity of vapour at the lowest temperature to which it may possibly be exposed as shall confer upon it both inflammability and an adequate luminosity, and this really means that at a higher temperature it will hold in solution a much greater quantity than is necessary in order to obtain such a result. In many cases, doubtless, this is the case.

The quantity of vapour held in solution at any one time, no matter at what temperature the observation be made, will be found to be just that quantity which would be found sufficient to saturate the air or gas at the lowest temperature to which it has been exposed; hence any lowering of the temperature after carburation should be carefully avoided, as a loss would thereby be incurred of a quantity of vapour which would not be restored on the temperature becoming again higher; this, of course, applies only to the gas or air after it has left the *liquid* hydrocarbon, and is not in contact with it.

The liquid hydrocarbons, which at present are almost exclusively proposed to be employed for the purposes of carburation, are the light oils and spirit which form the first distillate in the preparation of paraffin oil from the crude American mineral oil. As this light spirit is too volatile and inflammable to be burned in any sort of lamp at present in use, and no other commercial application has been discovered, very large quantities of it are disposed of as an entirely waste product, obtainable at a merely nominal cost. Whether the difficulties of importation, or its taking its position as a marketable product, will materially affect the estimates at present put forward for the continuous acquirement of large quantities, will remain hereafter to be seen.

With regard to these "air gases," all that remains is to state wherein the various plans differ in their mode of carburetting the air. The first of these recent schemes purposes to drive minute streams of air through a layer of spirit of a specific gravity 0·670—this is accomplished by forcing air under pressure through a small tank of the liquid, having a false bottom of wire gauze; the passage of the air through the gauze divides it into innumerable fine streams, and causes it to come into close contact with the liquid material. The air, as it issues from the top of the tank, will thus be saturated with the hydrocarbon vapour. The depth of liquid through which the air passes is maintained constant by means of a somewhat ingenious float. It is further proposed, in this patent, to dissolve in the spirit a quantity of some more highly condensed solid hydrocarbon; but it is open to very considerable doubt whether the effect of such addition could be very perceptible.

The illuminating power of this gas is very high, as high indeed as 30 candles, although this statement requires a slight qualification, as the lighting power of the flame is not expressed by it, but only the fact that if it were possible (which it is not) to burn the gas at the rate required by the photometric test, viz., five cubic feet per hour, this illuminating power would be obtained, it being a fact that a very much smaller amount of air gas can be burned from the ordinary "London Argand" burner, or from a bat's-wing, to obtain the same size of flame than in the case of coal gas; this effect is no doubt due to the greater density of "air gas." It may be mentioned here that these air gases do not burn at all well under pressure, and hence are only suited to burners which afford exceedingly free passage to the issuing gas, such as Argands, there being a tendency with burners of the bat's-wing and fishtail class for the air and vapour to separate, possibly explainable by the more rapid transpiration of the lighter substance through a narrow opening. The gas produced by this particular scheme possesses, as might be expected, a very fair degree of permanency at ordinary temperatures, and is capable of transmission through comparatively long lengths of pipe with little deterioration in quality. As an experimental trial, one side of the nave of the Crystal Palace has been recently lighted in this manner, with what success the public journals have testified, the spirit used for this purpose having a somewhat lower specific gravity than that mentioned in the patent. It is further stated that one gallon of oil will carburet 800 cubic feet of air, and the cost of this gallon of oil to be 2s.

A second plan for obtaining the same result is a modification of the above, the special features of which are, in the first place, the required current of air being maintained by clockwork, and, secondly, the substitution of a considerable length of cotton wool, or other absorbent substance, kept saturated with

the liquid hydrocarbon, in the place of bubbling the air directly through the liquid. The spirit used and the results obtained are very much the same as in the former case. This scheme also is being illustrated upon a somewhat extended scale, the small town of Great Marlow being at present illuminated by its means.

Perhaps this latter has one slight advantage over the former, inasmuch as the bubbling of air through a volatile spirit will promote its evaporation, to such an extent that the temperature of the liquid will be reduced exceedingly low, in some cases as low as the freezing point, and consequently the temperature of the air will be very considerably reduced at the same time. Now any unnecessary reduction of temperature, either of liquid or air, should be carefully avoided, in order to keep in solution as much vapour as possible.

Yet a third plan has received some attention which possesses at least the advantage of simplicity, and this consists in using an ordinary gasholder, with its tank, as a gas generator, to the exclusion of another apparatus. At the crown of this gasholder is placed a valve, opening with ease inward, but closing the moment any pressure is applied to the holder. Underneath this valve are placed trays containing a shallow layer of a spirit, if anything, of a somewhat lighter specific gravity than those used in other cases. As the gasholder is mechanically raised, the entering air passes over the surface of the volatile hydrocarbon, becoming in this manner sufficiently charged to be immediately used as an illuminating gas, which may be consumed through most ordinary fittings. The illuminating power of the flame, expressed in the same manner as before, is from 30 to 33 candles. The spirit—of which 1 gallon, it is believed, will carburet 500 cubic feet—used in this process is said to be obtainable in an almost unlimited quantity, being driven off on the first heating of the crude product in the manufacture of American kerosene oil. At present this volatile distillate is allowed principally to evaporate into the atmosphere; but it is thought that with very little extra expense or trouble, it may readily be condensed and imported. This spirit evaporates with extreme rapidity, as might be expected from its low boiling point; and the vapour proceeding from it, as from other petroleum spirits, is an exceedingly heavy one, almost as heavy, indeed, as the vapour of ether; hence, when mixed with air, it renders the mixture considerably heavier than an equal bulk of air, and this has been taken advantage of in the construction of what is certainly an ingenious arrangement, intended to be used as a portable gas lamp, or, in some cases, in place of the ordinary gaselier. A small reservoir communicating by a pipe with an ordinary gas-burner, provided with a stopcock, is filled with shavings or wool, which material is saturated with the spirit. The air and vapour descend together through the pipe to the burner, and produce a flame apparently equal, in all respects, to ordinary gas, the air entering through a small hole at the top of the reservoir. It is stated that half a pint of oil will be sufficient to saturate an amount of material to supply a light for nine hours.

It has often been thought that of a necessity these very volatile liquids must be much more liable to explosion than those of higher boiling points; such, however, is not the case, not but that it is possible to cause them to explode, because the vapour of any combustible hydrocarbon, when mixed with that proportion of air which contains just sufficient oxygen to burn up the hydrogen and carbon, will burn throughout at once, producing thereby sudden expansion, which is nothing more than explosion; but the conditions necessary, in order to obtain this result, are more difficult in the case of these heavy vapours of very volatile bodies, as, just above the explosive point, the air and vapour simply inflame and burn, while just below it inflammation will not occur at all from the presence of too small a quantity of vapour. This is contrary to the case of hydrogen gas, which explodes with ease when mixed with air in very variable proportions. The fear has been expressed that possibly, even after the complete mixture of such a heavy vapour and air, that separation other than condensation to the liquid state might occur, that is to say, that a layer of heavy vapour might lie at the bottom and a layer of the lighter air at the top; but the law of the diffusion of gases which states that gases and vapours, whatever their differences in density, will become, and remain completely mixed, invariably prevents such separation, just as in the atmosphere the heavier oxygen is not found at the bottom, and the lighter nitrogen at the top, but the two are found together in practically the same proportions from wherever a sample of air is obtained.

If comparisons be instituted between gases made in the ordinary manner and these air gases, they should be made under the same circumstances, and if this be done it will be found that coal gas itself suffers, either on exposure to a low temperature or by long keeping—not in any way a surprising result, since it contains the vapours of benzole, toluole, &c., which are capable of being condensed to liquids. In this respect rich gases always suffer the most; thus on continued exposure to a temperature of 0 deg. C., or 32 deg. F., gas made from cannel coal loses much more of its illuminating power than gas made from ordinary coal.

The employment of a combustible gas as the vehicle for holding in solution, and carrying the vapours of volatile liquids, appears at first sight to be a more rational and probably a more successful method of applying the principle of carburation, for in the former cases not only has a sufficiency of vapour to be retained to confer luminosity upon the flame, but a further quantity must be present for the production of the flame itself, or we may express this difference by saying that in the one case the combustible gas is already manufactured, and requires only to be endowed with luminous properties by the hydrocarbon vapour; in the other the combustible gas has itself to be manufactured, and then also, to acquire luminosity from the hydrocarbon vapour, and therefore it will be perfectly clear that a non-combustible gas will require to hold a larger quantity of vapour in solution than a combustible gas, in order to attain the same amount of lighting power. This statement does not, of course, deny the possibility of a non-combustible gas, such as air, acquiring and holding a sufficient amount of vapour, but all other things being equal, a combustible gas has a distinct advantage in this respect, and probably such a gas might be carburetted with a hydrocarbon liquid, having a lower boiling point, and hence less volatile than an incombustible gas, such as air. This advantage is also increased when air is employed, from the presence in it of one-fifth of its volume of oxygen, which burns up, without other effect than increasing the heat of the flame, a proportionate quantity of vapour. The nature of the combustible gas used is not of any very great importance, and hence cheapness and economy in production become the chief guides for its manufacture. The possibility, without any great amount of trouble, of obtaining a quantity of hydrogen gas from water has always been a favourite theme with inventors, and many schemes for its practical utilization have been introduced; but one hardly expected to recognize in a "new gas" our old friend this water gas once more; such is, however, the case, and a patent has lately been obtained for the carburation of this gas with some light hydrocarbon liquid. The plan is being carried out upon a small scale, and will doubtless very soon be tried upon a more extended one. The amount of attention that has been at various times bestowed upon this subject may be gathered from the number of patents obtained for the production of this so-called water gas. The first appears to have been granted to Michael Donovan in 1830, a second to George Lowe in 1831, a third to Gilbert Saunders in 1833, and two others to Mr. Floret and Jean Baptiste Molerat about the same time, and many others, all differing by some slight modifications, but all dependent upon the decomposition of steam by red-hot coal, coke, or metal. This decomposition takes place with very great ease whenever steam is passed over such heated material. Hydrogen, carbonic oxide, and carbonic acid being produced, probably two different actions take place, as expressed by the following equations:—

$$H_2O + C = H_2 + CO$$
$$2\,H_2O + C = 2\,H_2 + CO_2$$

The amounts of hydrogen, carbonic oxide, and carbonic acid obtained are variable under different circumstances. An analysis of the gas obtained by passing steam over red-hot charcoal for some hours gave as a mean—

Carbonic acid	20 per cent.
Carbonic oxide	20 ,,
Hydrogen	60 ,,
	100

Any form of carbon is capable of effecting this decomposition. If a metal, such as iron, be present, it adds to the quantity of hydrogen obtained according to the following action:—

$$4\,H_2O + 3\,Fe = Fe_3O_4 + H_2$$

This mixture of gases is inflammable, and burns with a non-luminous but hot flame, the heat of which would be increased if the carbonic acid were previously removed, the flame of hydrogen gas having a temperature of 3776 deg. Fahr. This heat of the flame is an undoubted advantage when the gas is carburetted, as the particles of carbon are thereby heated to whiteness; but on the other hand, the presence in the gas of a quantity of carbonic oxide is as great a disadvantage, on account of its injurious and exceedingly harmful character. Carbonic acid is an injurious gas, but its action upon the system is not that of an active poison, but rather that of preventing the necessary amount of oxygen from entering the lungs, and hence death from its effect will be death from suffocation. On the other hand, carbonic oxide is an active poison, and recovery from its effect is much more doubtful; indeed, it is calculated that 2 per cent. in any atmosphere would prove fatal, a result that should cause great caution in the use of a gas containing it in any quantity.

In this recent process it is proposed to use retorts of the ordinary description, set, as usual, in benches of five, seven, or nine. All except the upper one of each set are filled with some carbonaceous substance, usually coke, together with some scrap iron, or iron chairs, and heated up to a comparatively high temperature; steam—under pressure, generated from an ordinary boiler, and superheated by its passage through pipes set in and heated by the same furnace as the retorts—is introduced into the back of each retort, and has to traverse its whole length, passing through the red-hot coke and issuing from the front. During this passage the above decompositions take place. The upper retort is of a larger size, and is also filled with coke, but no steam is introduced into it; the gases formed and the remaining undecomposed steam from the other retorts passing through it together, this remaining quantity of steam being thus decomposed; and from this point the gas is treated precisely in the ordinary manner, and stored in holders, it being, in all respects, a permanent gas. It is intended to utilize this gas by itself, as a heating gas; but its chief use is for illumination, and the necessary luminosity is obtained in the same manner as with air gas, the gas being caused to bubble through some light spirit, any reduction of temperature by the rapid evaporation being avoided by maintaining the vessel containing it at a constant temperature by means of a steam-pipe. The illuminating power of the gas so obtained is equal to about 16 or 17 candles; and its permanent character is declared to be, and no doubt is, quite sufficient to render it of some practical utility. Let it, however, be borne in mind that no more union has taken place between the vapour of the hydrocarbon and the permanent gaseous mixture that in the case of the carburation of air, both gases taking up precisely the same quantity of vapour at the same temperature, and both being equally liable to be affected by changes of temperature, or other changes of circumstances. The whole of these carburetted gases are, of course, to a very large extent free from those impurities which are usually found in coal gas.

A suggested application of this principle of carburation, as an adjunct to the ordinary manufacture of gas, has many favourable points; for coal gas may most certainly be as successfully carburetted as either air or hydrogen and carbonic oxide, and it is quite possible to produce an exceedingly large yield of poor illuminating gas from coal, the luminosity of which might be brought up to the ordinary standard by partially carburetting the gas with some light hydrocarbon, the presence of a less quantity of vapour being requisite in a given bulk of gas, and hence a successful result would be more easily obtained, as the vapour would only have to raise the luminosity from a lower to a higher point, and not to do the whole work of illumination itself. A very large yield of gas from coal may be obtained by working at a high temperature, or at the ordinary temperature if a jet of steam be introduced into the retorts during the carbonization, it having been found possible to obtain by this latter method as much as 52,000 cubic feet from a ton of coal of an illuminating power equal to four candles.

In the preceding remarks an endeavour has been made to state and examine the claims of each of the processes brought forward in a clear and impartial manner. The extravagant statements and impossible theories sometimes put forward often obtain credence and support because those hearing them have seldom the necessary knowledge of the rudiments of chemistry or physical science to combat or disprove them; and very often such statements themselves are made in ignorance, and not with intent to wilfully mislead, by those who would be glad to state the truth if it were presented to them in a clear and succinct manner. Most schemes of this nature are open to conclusive proof with regard to their value and practicability, and in some cases this proof will be entirely to their advantage, and should not be shunned by their promoters. The introduction of so many new inventions just now, with regard to the manufacture of gas, indicates a great want somewhere, and if such a want exists it cannot be long before it is met and satisfied. Whether any of these present schemes are tending toward this satisfaction it is premature to say; this much may, however, be said, that hasty condemnation upon insufficient evidence is as much to be lamented and avoided as exaggerated and untruthful statements.

All mention of the commercial success of any of the above inventions has been avoided, as it was not intended, at the outset, to make this paper anything but an examination from a scientific point of view of such inventions. Doubtless there are those who are able to form an excellent judgment upon such matters as comparative cost of material, plant, labour, &c.; and this part of the subject must at all times have an exceedingly important influence upon any expressed opinion as to the profitable nature of any such undertaking.

Mr. H. P. Stephenson said he felt quite sure that every one present was greatly obliged to the able lecturer for the very interesting paper he had submitted to the meeting. There were, however, one or two points upon which he desired a little further information, and there were also one or two points upon which he might himself perhaps be able to throw a little light. In the first place he wished to ask Mr. Wills whether the hydrogen which he used as the vehicle for the petroleum in his experiments was free from carbonic oxide and carbonic acid, or whether he used pure hydrogen. He asked it for this reason, that the so-called "new gas," which Mr. Wills represented as not new but old gas, differed in this respect from the gas made under White's process, which a few years ago was employed to light up the town of Stockport, in that though it was formed of hydrogen as the vehicle produced in the same way, the illuminating power was obtained from the vapour of petroleum, and not, as in White's process, from the vapour from Boghead. It was found with White's process that not only was it commercially a failure, inasmuch as it could not compete with coal gas on the score of economy, but that there was a considerable difficulty in the mixing of the gases, so that while at one time the

illuminating power was equal to 30 or 35 candles from an Argand burner, at another time it had diminished to 6 or 7 candles. He had seen the "new gas" at Battersea, and he was bound to say that a very beautiful gas was produced there, and he was informed that by using petroleum of a certain specific gravity they could get the gas to travel very well. But he learnt from some able remarks in the last number of the JOURNAL OF GAS LIGHTING that at Chichester, where the experiment was being made of lighting the town with "new gas," though this gas burned exceedingly well in an Argand burner, it was not satisfactory when used with flat-flame burners. An attempt was then made to mix coal gas and "new gas" in equal proportions, which had succeeded, and the town was now lighted with that mixture. With reference to the point raised by the lecturer as to the poisonous character of carbonic oxide, he (Mr. Stephenson) remembered that some years ago experiments were made on the subject by Professor Frankland and the late Mr. Alexander Wright, in connexion with a patent obtained by a Mr. Gillard. By that process, which was an exceedingly beautiful arrangement, a stream of pure hydrogen was turned upon a platinum burner ring, the effect of which was to produce an intense white light. It was not necessary further to refer to the details of it, because the process was a failure commercially, and could not be carried out. But Messrs. Frankland and Wright made experiments at the time to ascertain the effect of carbonic oxide upon animal life as compared with the effect of ordinary coal gas. They experimented upon two unfortunate rabbits of about the same age and weight. These rabbits were from time to time exposed to the effects of certain quantities of coal gas, and at other times to similar quantities of carbonic oxide, not only in a pure state, but also mixed with given proportions of atmospheric air. It was a remarkable fact that in the result the experiments showed conclusively that carbonic oxide was no more poisonous to the rabbits than the carburetted hydrogen gas. By the "new gas" process the carbonic oxide and the carbonic acid were not removed, and he wished to ask Mr. Wills whether, in speaking of the poisonous character of carbonic oxide, he referred to it when in its unburnt state or after it was burnt. He presumed it was in its former condition, and if it happened then to escape into the atmosphere. The only other point to which he wished to allude was the experiment with air gas at the Crystal Palace. He was a director of the coal gas company supplying the district, and the mains of the company under the Palace were of a very complicated character. If the patentees of the air gas process were in the room, he should like to suggest to them that it would be only fair to them and to the coal gas company that the latter should be allowed entirely to turn off their supply before any further experiments were made to light the Palace with air gas.

Mr. GORE said, as he had had much commercial experience in the processes which Mr. Wills had brought before the meeting, he might be permitted to say a word or two in reference to it. In the first place, he must venture to correct Mr. Wills with regard to the date of the first introduction of air gas into this country. The first experiment made with air gas was in the year 1853 or 1854 by himself in connexion with the Leeds New Gas Company, under a patent granted to Mr. John Longbottom, who brought the invention from the United States. Mr. Longbottom's proposition was to use benzole, through which was pumped, by the aid of a combination of bellows, a stream of air, dried either by passing it through pumice stone or any other porous substance saturated with caustic potassa, for the purpose of absorbing the carbonic acid gas contained in it, and then through a porous substance saturated with sulphuric acid to absorb the watery particles or aqueous vapours in it. The air being driven through the benzole became an illuminating gas, and experiments were made by him at Leeds with this patent for three or four months. He believed that in all he made four or five hundred experiments to test the value of the process, and it was, perhaps, needless to tell the present audience that it resulted commercially in failure. He could fully endorse all that Mr. Wills had said as to the non-permanence of air gas when required to travel and when exposed to variations of temperature. And here, perhaps, the audience would permit him to make a remark, and that was as to the fallacy of judging of the permanence of this gas by simply exposing it in a gasholder. The truth of this observation was forced upon his attention during the course of the experiments to which he had referred. On one occasion he took a quantity of the air saturated with the vapour of benzole, and placed it in a gasholder, where it was allowed to stand for four days. On applying the photometric test at the end of that period he found that this air gas did not exhibit any remarkable deterioration in the illuminating power. But it so happened that this gasholder was required for another purpose, and it was necessary to transfer the gas to a small test gasholder which had been used for testing meters. This was at a considerable distance in another part of the works. On testing the gas after the transfer was made there was an appreciable difference and loss in the amount of illuminating power. On continuing the experiments, precisely the same results were obtained as had been exhibited this evening—viz., that as the vapour came in contact with a medium by which its tension was reduced, still greater and greater deterioration of illuminating power ensued. Passing now from "air gas," he might take up the other process specially alluded to by the writer under the term of "new gas." He had been one of those unfortunate individuals who at one time or other of his experience had had to make gas where no coal could be obtained, and this had driven him to try almost all these inventions. He was called upon in the year 1867 to light the city of Mexico with gas, and when he mentioned the fact that coal there cost for transport alone, irrespective of prime charge, £20 a ton, it would be seen at once that the expense of that article was tolerably prohibitory to the use of coal in that locality. But the gas-works were there, and he was bound to use them. He therefore made trial of two plans. The first was a modification of White's original hydrocarbon process—viz., the carburetting of combustible or partly luminous gases by passing them through or over the gas produced for resin, but substituting the wood gas of the country for water gas. The result was that he obtained precisely what was obtained by the new gas process, provided the fuel he employed had been sufficiently cheap for him to carry out the process effectually. But he abandoned this plan for the so-called water gas process, and he only regretted that on the present occasion he had not his drawings with him, which would have shown that "new gas" was simply an old friend with a new face. The gas which he produced was "new gas" in all its integrity, but it came to this in the end, that he could not obtain the requisite illuminating power without taking out the whole, or a very large portion, of the carbonic oxide and the carbonic acid, and when he had done that the cost of purification was so great that it was physically and commercially impossible to continue the system. He had therefore to return to the simple process of making gas from wood and resin, and from 1867 to the present time the city of Mexico had been lighted in that manner. He quite agreed with Mr. Wills that there was a too prevalent tendency to pooh-pooh scientific experiments, and attempts to apply science to the every-day processes of life, whether in connexion with gas lighting or anything else. But he must at the same time most unreservedly declare his conviction that, as practical men and men of business, they were bound to set their faces against the unwarrantable statements which were constantly being put forward in support of new schemes. A scheme which was perfectly feasible under certain circumstances, became commercially and physically impossible when applied under other conditions, and therefore he contended that it was misleading the public and imposing upon capitalists if they, as men acquainted with the subject of gas lighting, lent their authority to support, or expressed opinions favourable to some of these projects. It might be that some had in them the germs of excellence could they be properly carried out, but for the most part they were ill matured and inapplicable, and it was puffery of the worst description to follow the fashion so much in vogue to herald in these schemes with extravagant and misleading statements.

Mr. HOWLAND exhibited and explained an apparatus for manufacturing air gas, the invention of Dr. Greenhough, of America. It consisted simply of a small gasholder into which a quantity of petroleum spirit was poured; the holder was then raised so as to become filled with atmospheric air. This air at once became saturated with the vapour, and the gas thus produced burnt freely in an Argand burner supplied by a tube. He stated that the spirit employed was a bye product from the manufacture of kerosene oil, and that the process of thus making gas had been tried on a small and a large scale with uniform success.

Mr. SMART said he should like to know whether there was any danger from the use of this apparatus.

Mr. HOWLAND said it was one of the advantages which Dr. Greenhough claimed for his process that it was perfectly safe under all circumstances. To prove this he (Mr. Howland) would light the vapour on the surface of the liquid, and also boil some of the liquid over a lamp. Two gallons of this material produced 1000 cubic feet of the Greenhough gas, which would burn twice as long as ordinary coal gas and give one-third more light. As to its travelling capacity, it had as yet only been tried through a pipe a mile and a half long. The light was just as good at the end of that distance as at the beginning, and he saw no reason why it should not be conveyed through any length of main. But practically long pipes were not necessary; it would be much easier and better to have additional gasholders. The material from which the gas was made could be procured in London at less than 1s. per gallon, and in any quantity.

Mr. WILLS said very few questions had been put to him to answer. Mr. Stephenson inquired whether he used pure hydrogen in his experiments. He was doing so, and took occasion to state the fact during the lecture that he might not be misunderstood. With regard to his reference to White's hydrocarbon gas, it was not in connexion with the "new gas" scheme, but in connexion with a scheme known as Muschamp's patent for driving a current of steam into the retorts while coal was being distilled. With regard tothe poisonous qualities of carbonic oxide, of course coal gas itself was an exceedingly poisonous body, and he could understand a rabbit dying under its influence. But the question was as to the quantity of the gas present which would be necessary to kill and destroy animal life. A much smaller quantity of carbonic oxide than coal gas would destroy life. Taking the two substances in their pure state, death would be produced in about the same time by both, but the presence in the atmosphere of a much smaller quantity of carbonic oxide than of coal gas would be fatal. As to the other question, he might say that carbonic oxide ceased to be carbonic oxide, and became carbonic acid when burnt, and therefore he could only mean that it was poisonous in its unburnt state. Mr. Gore spoke of correcting him as to the date of the introduction of air gas. All he could say was that he searched back as far as he possibly could to find its first application, and he was now glad to find a date further back to which he could refer the origination of the scheme. And he would venture to say generally to all present who were interested in gas matters, "Do not oppose any scheme merely because it is a new scheme." If they could bring forth any proof, he did not mean exactly experimental proof, but any proof that would justify their condemnation, then condemn it; but because a new scheme was brought forward, or because it did not at first sight appear to be all that could be desired, it was unfair to denounce it unequivocally. It was not going in the right direction to put them all on one side at once with a sweep of the hand as unscientific or impracticable In the paper which he read he had endeavoured to make it as clear as he possibly could that he was not there to give a conclusive opinion upon any scheme whatever. There were gentlemen present who had come prepared to explain and illustrate the schemes referred to, but for his own part he was only there to make a "statement of the scientific principles" upon which they were based, and not to uphold or condemn any scheme whatever. He had simply stated the laws under which these respective schemes must fall; he had explained the scientific part of the question, leaving his audience to form the most accurate judgment on the facts they could. He had endeavoured to make the paper as wide in its scope as possible; all the schemes had been fairly and impartially looked at, and he hoped that no one would feel aggrieved at any word he had spoken, and that none would feel that any had been unnecessarily lauded.

The CHAIRMAN, in proposing that the thanks of the meeting be given to Mr. Wills, said the large attendance of members and friends proved conclusively the interest taken by the public in the matter of artificial illumination. He thought also that it showed there was a great want of improvement in this direction, and that whatever elucidation the question could receive at the hands of scientific gentlemen must be advantageous to the whole community. Mr. Wills had made a plain and clear statement of principles and facts, and had not in any way attempted to set one scheme over another. He had exhibited the scientific laws which ruled the whole. The laws which governed the generation of artificial light were fixed and definite, just as were all other laws of nature. Many of these laws were beyond human knowledge, but it seemed that those with which an acquaintance was necessary for the purpose of illumination were pretty well understood. He was sure, for the careful and elaborate paper which had been laid before the meeting that evening on this subject, the audience would cordially vote their thanks to Mr. Wills.

The motion was unanimously adopted, and the proceedings terminated.

CHELTENHAM WATER-WORKS COMPANY.—At a recent sale by auction, the £100 ordinary stock of the company sold for £150 16s., a premium of £51. This stock could be bought a few years ago at £90.

CONSUMPTION OF GAS IN NEW YORK.—The amount of gas consumed by the city of New York alone last year is estimated to be not less than 4000 million feet.

EXTRAORDINARY EXPLOSION OF GAS AT ELDERSLIE.—At a late hour on Sunday evening, May 18, a youth named Gault, who lives at Elderslie, near Johnstone, met with a remarkable accident. Seating himself on a kerbstone in the village street, he struck a match, and after lighting his pipe, pitched the match into the sewer at his feet. The result was,that a violent explosion of gas, which had generated in the drains, took place. The grating was torn off, thrown to a considerable distance, and the boy tossed into the air. His face and hands are burnt, but the other injuries are not serious.

EXPLOSION OF GAS AT NORTHAMPTON.—On Friday morning last, shortly before nine o'clock, an explosion of gas took place at the offices of the Northampton County Banking Company. It appears that the safe room is on the ground floor of the bank, immediately behind that in which the daily business of the bank is transacted. A small gas-jet is kept burning in this room during office hours, and at night is turned out. It was so on Thursday night, and it is supposed that while one of the servants was dusting the room, the cloth came in contact with the tap and turned it on again. The room was locked up directly afterwards, and the gas left escaping. It is the duty of the junior clerks to fetch out the books prior to the bank being opened, and it seems that the two injured young men, Mr. Daniels and Mr. Leet, went to the safe for that purpose shortly before nine o'clock on Friday morning. Mr. Daniels struck a match, the room being a darkened one, in order to light the gas, and immediately he opened the door the explosion occurred. Not a great deal of damage was done to the premises, but the two clerks were unfortunately injured very severely.

ADVANCES IN THE PRICE OF GAS.—The directors of the Bromsgrove Gas Company announce a rise of 8d. per 1000 cubic feet, bringing the price up to 5s. 4d. The directors of the Lewes Gas Company have given notice to the Borough Commissioners to determine the existing contract, whereby the public lamps were charged £3 5s. each, the company defraying the cost of lamps and lighting. A fresh contract has just been made at an increase of 10s. per lamp. At Cuckfield, Sussex, the price to private consumers has been increased from 6s. 8d. to 7s. 6d., and the Neath New Gas Company have raised their price to 5s. 6d.

EXPLOSION OF GAS AT MANCHESTER.—On Saturday last, about 8.45 a.m., an escape of gas was discovered at the Pleasant Inn, York Street, Cheetham. The landlord took a light near the gaselier in a front room, when the gas ignited at the bottom of the pipe. The room filled with flame, and an explosion occurred, which blew the front walls of the house into the street. The landlord, Mr. C. G. Melville, found his clothes on fire, but he managed to turn off the gas at a meter. He and Mrs. Melville were then removed to the infirmary to have their injuries attended to, and afterwards to a neighbour's house. Mr. Melville's mother and three children, who were in a back room when the explosion occurred, escaped unhurt. The house and contents are damaged to the amount of £300 or £400, covered by insurance.

PUBLIC LIGHTING AT BOSTON.—A special meeting of the local board was held on Friday, May 23, to consider a fresh proposal from the gas company as to lighting the public lamps after the expiration of the existing contract. The mayor presided, and the clerk read the following resolutions which had been forwarded to the board by the gas company:—"In reply to the resolutions received from the Sanitary Authority, dated April 29th last and the 5th of May inst., it is resolved as follows:—That the company will supply the public lamps with gas for five months, commencing the 1st of August and ending the 31st of December next, according to the scale submitted to this meeting by the Sanitary Authority, under date of the 29th of April last, at the rate of 5s. for each 1000 cubic feet of gas. That the company will continue to light and extinguish the public lamps, and to paint and repair the same, and also to take down and replace the same, at the sum of 7s. per lamp up to the same date. The meters to every tenth lamp to be affixed are to be wet meters in an iron case and buried deep, so as not to be affected by frost. The meters are to be supplied by the Sanitary Authority, and are to be tested by the company before they are affixed, and to be affixed to the satisfaction of the company; but should the company find the metage system of one meter to every tenth lamp unsatisfactory, they shall call upon the Sanitary Authority to introduce a meter to every lamp." After some discussion it was resolved by the board—"That the Sanitary Authority is willing to abide by the agreement entered into with the gas company on the 6th of January, 1873—viz., to burn by average meter indication, one meter to every tenth lamp; the price to be the lowest charged to any private consumer; and further, that for the future the Sanitary Authority must be allowed to light, clean, and repair its own lamps, so as to have full control over its own property, and that the agreement shall endure for a term of not less than 12 months."

SALE OF THE BELFAST GAS-WORKS TO THE CORPORATION.—A special meeting of the shareholders of the Belfast Gas Company was held at their offices in Leicester, on May 9, to consider the agreement entered into by the directors with the corporation for the purchase and transfer of the undertaking to that body. Mr. Hutchinson, chairman of the company, presided, and the clerk having read the agreement for handing over the works to the corporation as and from June 30, 1874, for the sum of £386,550, the chairman said he did not suppose that it would take the shareholders by surprise to hear that the directors had concluded this agreement with the Belfast Town Council. They had from time to time been told that that body intimated a desire to become the proprietors of the works, and manufacture gas themselves for the population. The matter had occupied the very serious attention of the directors from time to time, and, provided that fair terms could be secured, they recommended the transfer of the works. After considerable time had been spent in arrangements, the directors sent every shareholder a printed copy of the heads of the agreement, and they had now heard them read *in extenso*. The chief conditions remained the same as in the printed papers. The purchase-money remained at £386,550, that being at the rate of 22½ years statutable dividend. The main alteration was in clause 6. At the recent interviews which the directors had with a deputation from the Town Council, it was stated by the deputies that they had a great desire to enter into possession of the works on June 30, 1874, or as soon thereafter as the Act of Parliament would permit. They tendered their police-rates as security, which had a very large margin, so that the directors thought there would be no risk whatever in letting the corporation into possession of the works. Besides having the large margin of police-rates, they had the gas-rents to rely upon. He believed the present margin was between £20,000 and £30,000 per annum. They had also altered the bill introduced into Parliament in the early part of the present session. At first they applied for £100,000 share capital, and £25,000 of borrowed money; but, by arrangement with the Town Council, the bill had been altered so that the capital authorized should not exceed £20,000, with interest not exceeding 5 per cent., and redeemable upon certain terms. The borrowing powers were thus reduced from £25,000 to £5000. He thought the shareholders were of opinion that the loans which had received the sanction of the directors were fair, and, at all events, were not more than they were entitled to ask the Town Council of Belfast to give. They were letting that corporation into very valuable works in first-rate order, so that they should have no difficulty in carrying on the supply of gas to the consumers of Belfast in a satisfactory manner. He moved—"That this company do agree to sell this undertaking to the mayor, aldermen, and burgesses of the borough of Belfast, on the terms and conditions mentioned and set forth in the articles of agreement, and that the common seal of the company be affixed thereunto." Mr. Billson seconded the resolution, which was unanimously adopted.

THE KROMSCHRÖDER GAS.—On Saturday, the 17th, and Friday, the 23rd ult., a number of gentlemen assembled by invitation at the gas-works, Great Marlow, Bucks, to witness the process of manufacturing gas under a patent taken out by Mr. J. F. G. Kromschröder, a German engineer who has for some years been resident in this country. Mr. Kromschröder is properly careful to guard against being supposed to lay claim to the discover of "air gas;" he simply professes to have invented and applied an improved apparatus for producing inflammable gas or vapour by passing a stream of air through an absorbent material saturated with hydrocarbon. The machinery he employs consists, according to his specification, of a chamber or generator, containing an air-forcing apparatus, driven by clockwork. Surrounding this chamber is an outer casing, and the space between the two constitutes a reservoir for holding a supply of liquid hydrocarbon. Below this air-forcing chamber is formed a vaporizing chamber, which is divided by partitions so as to provide of an extensive vaporizing surface. This latter chamber contains wool or horse-hair, and the supply of hydrocarbon to it from the reservoir is regulated by a bird-fountain arrangement. The current of air is admitted to the centre of this chamber, and is drawn off at the circumference, after permeating the absorbent material saturated with the oil. This vaporizing chamber is surrounded with a thick jacket or coating of non-conducting material to protect it from the influence of extreme cold, which, says the inventor, "would otherwise affect prejudically the working of the apparatus, and diminish the illuminating power of the light. The non-conducting material preserves the generator at a uniform temperature, whereby the gas produced will maintain a constant illuminating power." The apparatus employed at Great Marlow stands about 4 feet high from the ground, and is 7 feet by 5 feet 9 inches in dimensions. Mr. Kromschröder, who was present to explain the process, stated that for three months past the town had been almost entirely lighted with gas so manufactured, the control and management of the apparatus being under the sole direction of Mr. Hastings, the lessee of the coal gas-works, and that there has been no interruption or failure in the service during that period. It appears, however, that at times the air gas has been mixed in various proportions with ordinary coal gas, the result of such mixture being, as was stated, materially to increase the illuminating power of the latter. Great Marlow is a straggling town, with a population of some 5000 inhabitants. No portion of the district lighted seems to be on a much higher level than the gas-works; the mains, which are small and very irregular, have a length of about 4½ miles, and the nightly consumption of gas averages between 5000 and 6000 cubic feet. Passing from the generator, the Kromschröder gas is conveyed at once into the usual gasholder for immediate distribution, but it was stated that some which had been stored for ten days in a small holder was found not to have deteriorated to any great extent. The average illuminating power was said to be 25 candles, and variations of temperature do not in any way influence it. The specific gravity of the hydrocarbon oil employed is 660, and that of the gas manufactured from it 1250. The guests invited to view the process were handsomely entertained at the Complete Angler Hotel, by the gentlemen who are interested in the commercial success of the invention, and who, having satisfied themselves of its practical utility, will, we presume, before long, invite the investing public to share in its advantages.

Register of New Patents.

2711.—RUCK, W. D., Greenwich, "*Improvements in the manufacture of gas.*"
Patent dated Sept. 12, 1872.

This invention relates to certain improvements in the manufacture of gas for heating or lighting purposes.

It is well known that by passing currents of air through ordinary liquid hydrocarbon, a gas that is used for lighting and sometimes for heating purposes is produced, and the inventor has discovered that a superior gas may be produced by passing through hydrocarbon spirit currents of hydrogen gas, prepared and treated as hereafter described.

The invention is designed first for the purpose of manufacturing or producing gas for heating purposes from the products of coal or other carbonaceous matter treated with iron, steel, or other metals, by the means and in the manner following:—

It is proposed to employ coal and its products or any carbonaceous matter in conjunction with iron, steel, and other metals in scrap or otherwise. These when so mixed are placed in retorts, ovens, or other receptacles, to be brought to a high temperature through the agency of external heat in the presence internally of superheated steam by which means hydrogen and oxide of carbon with carbonic acid and sulphuretted hydrogen are produced.

In order to produce a large quantity of gas, a large furnace supplied with one or more sets of grates or fires is employed, in which are arranged and supported in a pyramidal or other suitable form a stack or bench of two, three, five, seven, nine, or other number of retorts or chambers set in a position best adapted to receive the greatest amount of heat from the fuel of the furnace. If, for example, nine retorts are used, eight of them are constructed of one given size, which are filled with the carbonaceous matters and metal or metals before mentioned, after which they are hermetically closed by their lids or covers, each retort being provided with a mouthpiece projecting from the front of the retort, and forming when closed a portion of the same. The ninth retort or chamber is made larger than the others, but connected with them as described hereafter; this retort is also filled with carbonaceous matters, or is so constructed that it can present a great amount of internal heating surface; for instance, it may be constructed so as to have a number of tubes running through it, similar to the tubes of a locomotive or multitubular boiler, or other equivalent heating surface, against or through which the heat of the surface will impinge or pass in its course to the flue.

Above these retorts or on one side thereof, or in any other convenient position in connexion with the before-mentioned furnace (or if desired in a separate furnace), is placed a boiler or boilers in which steam is generated. A pipe from this boiler is connected with a superheating apparatus also set in the same furnace, the steam from which is conveyed by pipes into each of the eight retorts, which when filled with the carbonaceous matter, scrap iron, or other metals, are separately connected by a main or pipe which conveys the products into the ninth or larger retort. The superheated steam (when the process of manufacturing gas is proceeding) enters the heated retorts containing the carbonaceous matters and metal through the medium of a pipe supported internally within each retort upon ledges, channels, or grooves that terminate within a few inches of the rear end of each retort, the superheated steam being caused to pass through and over the carbonaceous matters, and heated metal carbonic oxide and hydrogen gases are generated. From each one of these retorts the gases so generated are conveyed through the medium of connecting-pipes to the main before mentioned, and thence into the ninth or larger retort where any steam then remaining unconverted becomes thoroughly decomposed, and where, if there be any carbonic acid or bisulphide of carbon present, they may be destroyed. The gas from this retort may be withdrawn by means of an exhauster or other equivalent, and passed through a condenser of the ordinary or other convenient form into the receiver or gasholder, where it is stored in the condition of a permanent gas which may be employed for heating purposes.

This invention is also designed for the purpose of manufacturing illuminating gas. The hydrogen gas, prepared and treated as above described, is made into an illuminating gas by the following process:—

A gasholder or receptacle containing hydrogen gas prepared as above described is connected by means of a pipe (having governing or regulating cocks or taps) with an ordinary gas purifier and a closed chamber or receptacle. The closed chamber is supplied with hydrocarbon spirit, which should be a spirit which distills at from 50° to 70° of Centigrade, from a cistern containing the same through the medium of a pipe, and is regulated in its flow thereto by governing taps. The receiving closed chamber is also supplied with indicators for regulating the height or quantity of spirit admitted, and a thermometer for indicating its temperature is attached thereto.

The pipe forming the communication between the closed chamber or receptacle and the purifier and gasholder terminates at a point in such chamber that will admit of its being constantly immersed in the spirit contained therein; this closed chamber is also provided with an internal coil or other form of pipe through which steam or hot air is caused to pass to maintain the spirit contained in the chamber at one uniform temperature of about from 60° to 70°, or if desired other heating mediums may be employed for the same purpose. Thus the gases, after having been prepared as before mentioned, will, when admitted into this chamber from the gasholder, become impregnated with the spirit whilst passing through the same.

Care should be taken to prevent too low a temperature from being produced, as it will be found to prevent the absorption of the spirit, hence the necessity of the heating medium, which must be governed so as to maintain the spirit or contents of the closed chamber at about the temperature above mentioned.

The hydrogen and other gases thus saturated with the hydrocarbon spirit may be passed through a condenser filled with water, or other ordinary

form of condenser, and thence into and through the service-pipes. These gases, previous to their passing through hydrocarbon spirit, have great heating properties, and they only require a small amount of the said spirit to render them illuminating. On this account the manufacture of the improved gas, being a permanent gas, is more efficient and economical, having regard to the results produced, than the manufacture of what is ordinarily termed air gas by the ordinary method.

2847.—HARRISON, C. W., and HARRISON, A. H., both of High Holborn, "*Improvements in combining atmospheric air and certain gases for lighting and heating purposes.*" Patent dated Sept. 26, 1872.

This invention relates to improvements in combining atmospheric air and certain gases for lighting and heating purposes, with the object of obtaining, amongst other advantages, a greater light or heat at an equal cost to or an equal light or heat at a less cost than what has hitherto been accomplished.

The gases used for the purposes of this invention may be of any description, composed wholly or principally of hydrogen and carbon, and the proportion of air to be combined, mixed, or used therewith will vary according to the richness of such gases in carbon, the purpose or purposes for which they are intended to be used, and from other causes—such, for example, as the varying degree of humidity of the atmospheric air thus combined with them.

By mixing atmospheric air in proper proportions with gases of the above description their volume is proportionately increased without any additional expense, whilst, at the same time, they consume more slowly, and their light and heat-giving powers (according to the purpose for which they are used) are materially augmented by reason of the more perfect combustion obtained in consequence of the thorough diffusion throughout the gas of the oxygen of the air thus introduced, and the immediate presence of such oxygen with the minute particles of carbon, which are thereby perfectly consumed; moreover such gas thus mixed with air does not when in combustion depend on the surrounding atmosphere for the necessary amount of oxygen, such surrounding atmosphere being therefore much less vitiated than by the combustion of gas unmixed with air.

In carrying out this invention care must be taken that in mixing the air and gas the proper proportions are combined, as on the due observance of this particular the success of the invention depends, and as these proportions will vary according to the richness of the gas in carbon and from other causes, such, for example, as the varying degree of humidity of the atmospheric air thus combined with it, and whether it be required to be used for lighting or for heating purposes, it becomes necessary to provide means by which the proper proportions can be fixed at all times, and under the varying circumstances and conditions likely to be encountered in carrying this invention into effect. When the gas to be thus combined with air is intended for lighting purposes, the proper proportion of air to be mixed therewith may be determined by the use of the photometer in the following manner:—The exact proportion of air to be combined with the gas is that that will supply such quantity of oxygen as will more completely perfect the combustion of the carbon of the gas, and so utilize to the fullest extent the whole of the illuminating power of such gas. This proportion may be fixed as follows:—Given a quantity of any particular gas which it is required thus to treat by the addition of air, a small pipe is led from the holder containing the gas, such pipe being provided at its further end with a burner so arranged in connexion with a photometer that when the gas issuing from the burner is ignited the illuminating power of the flame may be observed; air is then gradually forced or drawn into the holder containing the gas, amongst which it diffuses itself; and, as it is introduced, the flame under observation will be found to gradually increase in illuminating power. The addition of air to the gas is therefore continued as long as the flame shows increasing illuminating power, but is stopped when such illuminating power has reached its highest point, which may be readily determined by its remaining for a short time without change, shortly after which, if the addition of air be kept up, the illuminating power will begin gradually to diminish.

The above process may be carried out without the least danger of forming an explosive compound, as to produce such would require a much larger proportion of air than that at which the greatest illuminating power is obtained.

It will be obvious from the foregoing that the above method of determining the proportions may be carried out in connexion with the whole bulk of the gas, or that a small portion of the bulk may be taken and so treated to fix the proportions in which the combination shall be effected, which having been thus obtained, the proper quantity of air may then be added to the bulk of the gas.

When the gas to be thus combined with air is intended for heating purposes, a similar method is carried out in connexion with a pyrometer, that is, a small flame of the gas is so arranged in connexion with the pyrometer that the heating power of such flame may be tested whilst air is being gradually added to the gas, the addition of air being stopped when the highest point of heating power has been reached. The proper proportions of air and gas are thus fixed. As in this case the mixture thus formed is highly inflammable, it is advisable to fix the proportions by experimenting on a small portion of the gas only, and to have inserted in the pipe, through which the gas is conveyed, one or more partitions of fine wire gauze to prevent the flame running back into the holder. It is also advisable in using the gas so combined with air to be similarly protected with one or more partitions of wire gauze, and to maintain a good pressure behind the gas, as this will also tend to prevent any flame returning. It is further advisable to convey it to the point where it is to be consumed through as small tubes as possible, even if several of such tubes have to be used together to supply a sufficient quantity.

It will be obvious from the foregoing that the proper combination may be effected with the bulk of the gas, which would then be supplied thus combined with the best proportion of air. The combination may, however, be effected at or near the point where the gas is to be used. In such case a convenient method of accomplishing this is as follows:—The air to be combined with the gas is introduced by a fan or other convenient air-forcing apparatus into the pipe conveying the gas to the place where it is to be consumed. This fan is made adjustable so that the supply of air can be regulated at pleasure. Thus a small flame of the gas so combined with air being arranged as before described in connexion with a pyrometer, the proper proportion of air to be mixed with the gas may easily be determined, and be regulated even to suit the varying qualities of gas supplied and other circumstances affecting the proportions of the mixture. For many purposes this is the preferable method to adopt.

It will be found, in practising this invention, that both for lighting and heating purposes heavy hydrocarbon gases will bear a very large proportion of air mixed with them. Thus, for lighting purposes, the gases given off at a red heat from cannel coal during the first hour, and having a sp. gr. of about 0·680, will bear mixed with them from four to five times their volume of air; those given off during the second hour at the same heat, and having a sp. gr. of about 0·420, three to four times their volume; those given off during the third hour, and having a sp. gr. of about 0·400, from two to three times their volume; and those given off during the fourth hour, and having a sp. gr. of about 0·350, from once to twice their volume. For heating purposes, these gases will bear combined with them from one to two more volumes of air for fixing the exact proportions; however, it is preferred employing the means above set forth.

APPLICATIONS FOR LETTERS PATENT.

1794.—BOURFIELD, G. T., Sutton, Surrey, "Improvements in motive-power engines to be worked by steam or other fluid, applicable also to meters and pumps." A communication. May 16, 1873.

1799.—CAPPALL, R. M., Alton, Hants, "Improved means of and appliances for automatically preventing the back rush of gas from gasometers, for purifying the gas, and for improving the brilliancy of the lights or flames of gas." May 17, 1873.

1805.—HAMMETT, S. H., Southwark, "Improved apparatus for regulating the supply of water to water-closets and other places." May 19, 1873.

1807.—TELLING, W. A., and JOHNSON, S., Wood Green, "Improvements in gas-meters." May 19, 1873.

1834.—NEWTON, H. E., Chancery Lane, "Improvements in hydraulic engines for raising water and for obtaining motive power." A communication. May 20, 1873.

1852.—IMRAY, J., Chancery Lane, "Improvements in apparatus for supporting respiration and light in suffocating atmospheres and under water." A communication. May 22, 1873.

1853.—OBSAT, L. H., Paris, "An improved apparatus for analyzing gas." May 22, 1873.

1859.—LAKE, W. R., Southampton Buildings, London, "Improvements in gas purifying and regulating apparatus." A communication. May 23, 1873.

1887.—BOX, W. W., Gas-Works, Crayford, "Improvements in apparatus used in the manufacture of gas." May 26, 1873.

1894.—SPENCER, W. H., New York, "Improvements in the process of and apparatus for manufacturing illuminating gas." May 26, 1873.

GRANTS OF PROVISIONAL PROTECTION.

1681.—RICHARDS, W., Brixton, Surrey, "Improvements in the manufacture of pipes for conveying water, gas, air, sewage, and drainage." May 9, 1873.

1697.—HASELTINE, G., Southampton Buildings, London, "An improved method of and apparatus for lighting and extinguishing gas-burners." A communication. May 10, 1873.

1713.—CLARK, A. M., Chancery Lane, "Improved apparatus for lighting lamps, candles, and similar purposes." A communication. May 10, 1873.

1752.—POTEL, A. P., Brussels, "Improved joints for water, gas, steam, and other pipes." May 14, 1873.

1765.—HEAP, J., Oldham, "Improvements in screwing tackle, and in apparatus for screwing metal tubes." May 14, 1873.

1784.—HARRISON, C. W., High Holborn, "Improvements in the manufacture of gas." May 15, 1873.

NOTICES TO PROCEED.

154.—SCOTT, H. Y. D., Ealing, Middlesex, "Improvements in the treatment of sewage and of the deposits obtained therefrom." Jan. 14, 1873.

183.—SCOTT, H. Y. D., Ealing, Middlesex, "Improvements in the purification of coal gas." Jan. 16, 1873.

556.—ATKINS, F. H., Fleet Street, London, "Improvements in apparatus and in the materials and appliances employed for the filtration of water, sewage, and other fluids, whereby manure and other valuable products are separated, precipitated, and obtained therefrom." Feb. 14, 1873.

896.—DARWIN, S. B., Shrewsbury, "Improvements in the means of manufacturing gas." March 12, 1873.

1507.—WRIGHT, W., Sheffield, "Improvements in the manufacture of gas for heating and illuminating purposes, and in apparatus for the same." May 3, 1873.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

3047.—MURDOCH, H. H., Staple Inn, Middlesex, "Improvements in the joints of pipes or tubes." A communication. Dec. 3, 1872.

3052.—TEALE, W. E., Mark Lane, Manchester, "Improvements in guards for gas-lights, and in an improved method of lighting gas while under the protection of guards." Dec. 4, 1872.

257.—NEWTON, A. V., Chancery Lane, Middlesex, "Improvements in apparatus for applying steam to the raising and forcing of water and other liquids." A communication. Jan. 22, 1873.

372.—JONES, D., Inverness, N.B., "Improvements in apparatus for forcing in liquids or fluids." Jan. 30, 1873.

937.—DEACON, G. F., Liverpool, "Improvements in apparatus for measuring the flow of water in pipes." March 14, 1873.

1066.—JOBSON, E. W., Derby, "Improvements in apparatus for controlling the supply of water to water-closets and such like places, and in effecting the measurement of the water supplied for such and other purposes." March 21, 1873.

DUKE OF HAMILTON'S

LESMAHAGOW GAS COAL.

LESSEES:

LESMAHAGOW AND LONGLEE COAL COMPANY,

Office—5, DIXON STREET, GLASGOW.

Works—BLACKWOOD & SOUTHFIELD, LESMAHAGOW

English and Foreign Agents:

JAMES MILLER, SON, & CO.,

9, GRACECHURCH STREET, LONDON, E.C.,

AND

75, UNION STREET, GLASGOW.

LIVESEY FIRE-CLAY WORKS,

NEAR BLACKBURN, LANCASHIRE.

(ESTABLISHED 1835.)

ORLANDO BROTHERS,

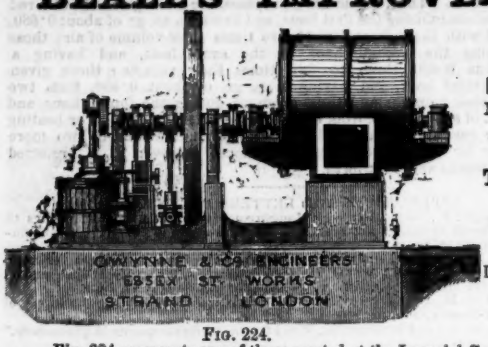
MANUFACTURER OF PATENT CLAY RETORTS,

AND EVERY DESCRIPTION OF

TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.

FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

BEALE'S IMPROVED PATENT GAS-EXHAUSTERS,



WITH
GWYNNE & BEALE'S
PATENT
IMPROVEMENTS,
Made under the personal superintendence of
Mr. BEALE,
The oldest Maker, Inventor and Patentee of GAS-EXHAUSTING MACHINERY.
It is NOT CORRECT to state that Mr. BEALE has RETIRED.

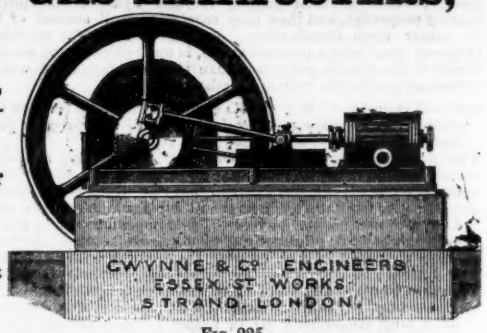


FIG. 224. FIG. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the **most perfect system of action yet discovered.** Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND Co. do not pretend to enter into a struggle with other makers in respect to **cheapness.** They have never sought to make **price the chief consideration,** but to produce Machinery of the very highest quality, and the most approved design and arrangement. Their prices have been estimated with a due regard to the **excellence of the article produced,** and when this is taken into consideration, they have no fear for the result.

The orders executed this season for Exhausters and alterations to their patented system, amount to over 3,000,000 cubic feet of gas passed per hour, and to over 200 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction.

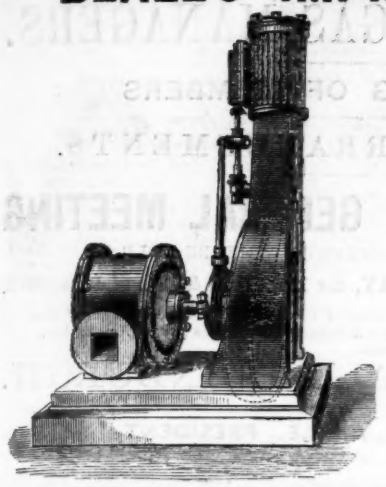
REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES,
CAN BE HAD ON APPLICATION TO
GWYNNE & CO., HYDRAULIC & GAS ENGINEERS, ESSEX STREET WORKS, STRAND, LONDON, W.C.
Prices and every information on application.
G. & Co. are now manufacturing for a London Gas Company two of their 210,000 cubic feet Patent Gas Exhausters.

DUKE OF HAMILTON'S
LESMAHAGOW GAS COAL.
The superior quality of this well-known Cannel, as wrought by
THE NITSHILL AND LESMAHAGOW COAL COMPANY,
Is now generally admitted by all Gas Engineers.
PRICE AND ANALYSIS MAY BE HAD ON APPLICATION TO
JAMES M'KELVIE, HAYMARKET, EDINBURGH.

HODGE & CO.'S
IMPROVED VENTILATING SUN-LIGHTS
WITH TALC REFLECTORS AND SELF-ACTING VALVES
TO PREVENT DOWN-DRAUGHT;
VENTILATING GLOBE LIGHTS for DINING-ROOMS, LIBRARIES, &c.
Ormolu, Bronze, & Crystal Gaseliers;
MEDIÆVAL CHURCH WORK AND CORONÆ;
COCKS, VALVES, and FITTINGS for GAS, STEAM, and WATER;
COLUMNS, BRACKETS, & STREET LANTERNS;
BLACK AND GALVANIZED BARREL COMPO AND TIN PIPE.
GAS ENGINEERS,
100, HATTON GARDEN, LONDON.
Drawings and Prices upon application.

VICKARYS AND ROBERTSON,
Late JOHN VICKARY,
ESTABLISHED 1840.
GAS ENGINEERS, CONTRACTORS, IRON AND BRASS FOUNDERS,
WEST OF ENGLAND ENGINEERING WORKS, EXETER.
GASHOLDERS AND TANKS,
Retorts, Retort-Fittings, Condensers, Scrubbers, Purifiers, Station-Meters, Governors, Rack and Screw Valves. Gas and Water Mains always in Stock.
STEAM-ENGINES, EXHAUSTERS, SHAFTING AND GEARING, &c.
GAS-FITTINGS,
Including Chandeliers, Pendants, Hall Lamps, Brackets, Star and Sun Lights of all designs.
WET & DRY GAS-METERS,
Combining most recent improvements in principle and manufacture; upwards of 200,000 already in work, giving highest satisfaction.
(A guarantee of five years given with every Meter.)
PLUMBERRS WORK, including Lift and Force Pumps; Cocks for Gas and Water and Steam; Brass Fittings.
HYDRAULIC AND GENERAL ENGINEERING.
LONDON OFFICE: 8, JOHN STREET, ADELPHI, W.C.

BEALE'S IMPROVED PATENT GAS-EXHAUSTER

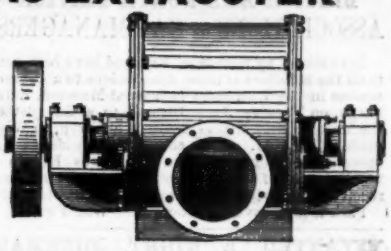


WITH

ENGINE COMBINED

ON

ONE BASE PLATE.



SOLE MAKERS,

GEORGE WALLER & CO.;

Who, since Mr. BEALE'S retirement, are the Oldest Makers.

EXHAUSTERS with HORIZONTAL ENGINE combined.
EXHAUSTERS with OUTSIDE BEARINGS.
MAKERS of ENGINES, BOILERS, and GAS MACHINERY.
TAR, LIQUOR, and SYPHON PUMPS. GAS-VALVES in stock, 2 to 30 inches.
SELF-ACTING BYE-PASS VALVES, with Lid and Relieving Lever.
MANN'S and many other descriptions of WATER DISTRIBUTORS,
SCRUBBERS, PURIFIERS, and CONDENSERS.
EXHAUSTERS from 3000 to 60,000, new and second hand, in stock.

PHŒNIX ENGINEERING WORKS, HOLLAND STREET, S.E., & at STROUD, GLOUCESTERSHIRE.

THE STEAM STOKER COMPANY, LIMITED,

ARE NOW PREPARED TO GRANT

LICENCES FOR THE USE OF THEIR VARIOUS PATENTS

FOR

STOKING BY MACHINERY.

UNDER one or the other of their Patents, Machines can be adapted to almost any existing works without material alteration of the Retort-Houses or Settings.

Applications, accompanied by full particulars as to dimensions in the Retort-Houses, Settings of the Retorts, &c., &c., should be addressed to the Secretary, at the Offices of the Company,

155, FENCHURCH STREET, LONDON, E.C.

SIDNEY LEONI & CO.,

19, GREAT GEORGE STREET, WESTMINSTER, S.W.,

AND

ADAMAS WORKS, ST. PAUL STREET, NEW NORTH ROAD, N.,

MANUFACTURERS OF

GAS AND HOT WATER APPARATUS,

AND OF THE WELL-KNOWN

PATENT ADAMAS GAS-BURNERS.

A LARGE STOCK OF ALL KIND FOR FAMILY USE ALWAYS READY.

They have fitted up Cooking Apparatus in large Establishments, where savings of £300 per annum have been effected.

See "Report of the London Hospital," JOURNAL OF GAS LIGHTING, *Aug.* 13, 1872, *No.* 517.

ESTIMATES ON APPLICATION.

WILLEY AND FORD,

GAS ENGINEERS,

WORKS: COMMERCIAL ROAD, EXETER,

INVITE THE ATTENTION OF GAS COMPANIES AND OTHERS FOR THE SUPPLY OF

EVERY DESCRIPTION OF GAS APPARATUS.

ENGINEERING DEPARTMENT.

NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

GASHOLDERS AND TANKS.

RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

METER DEPARTMENT.

They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

GAS-FITTING DEPARTMENT.

An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.

PATTERN-BOOKS and PRICE LISTS furnished.

☞ PLEASE NOTE THE ADDRESS—

GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

TO THE MEMBERS
OF THE
BRITISH AND NORTH BRITISH
ASSOCIATIONS OF GAS MANAGERS.

Invitations by friends in Scotland have been sent to all the members of these Associations to a *Conversazione* in the University Industrial Museum, Edinburgh, on Tuesday, June 10; and to a Banquet in the Masonic Hall, George Street, Edinburgh, on Wednesday, June 11. From changes of residence and other causes some of these invitations have not reached some of the members. If any who have not received them will apply to me, tickets will be sent.
Park House, Inverkeithing. WM. FRASER.

WANTED, a NIGHT FOREMAN,
Address the MANAGER, Gas-Works, CAMBRIDGE.

WANTED, by a thoroughly practical Man of general experience, a situation as MANAGER of Gas-Works. First-class references and security, if required.
Apply to F. F., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser, a situation as MANAGER or FOREMAN of Gas-Works. Is well up in the making and distribution of gas in all its branches. First-class references.
Address D. H., Messrs. Chandler and Son, Gas Engineers, York Street, London Road, SOUTHWARK.

WANTED, a steady, active Working FOREMAN, who thoroughly understands the manufacture of gas, the setting of retorts, laying of mains and service-pipes, and fixing of meters. A smith preferred.
Applications, with reference, and wages expected, to be addressed to F. W. OLDFIELD, Manager, Sutton Southcoates and Drypool Gas Company, HULL.

WANTED, by a thoroughly practical Man, having over 20 years experience, a situation as MANAGER in a Gas-Work, where the annual make is about 20 million, or SUPERINTENDENT in a large work.
Address B. Y., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a well-educated young Man, an appointment as DEPUTY-MANAGER or MANAGER of a small work. Has a thorough knowledge of the manufacture and distribution of gas, and the whole routine of a Gas-Work. A good draughtsman, and possesses a sound knowledge of French. Has no objection to go abroad. Unexceptionable references from present employer, with first-class testimonials.
Address YOUNG, care of W. H. Bennett, Esq., 42, Parliament Street, LONDON, S.W.

WANTED, by the Advertiser, an appointment as out-door Superintendent or Secretary and Manager of Gas-Works. Has been for the last 12 years with eminent Gas Engineers and Contractors at works where the annual make of gas is 80 million feet. Has also practical knowledge of the improved methods of gas testing for purity and illuminating power, &c., and can produce the highest references as to character, ability, and general business qualifications.
Address A., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

"DON" ECONOMIC LUBRICATING OIL is about 40 per cent. cheaper than the kinds heretofore used by Gas Companies, many of whom have adopted it. The Alliance Gas Company say, "Your 'Don' Oil gives us every satisfaction." Trial casks sent on approbation.—DUNCAN BROTHERS, 2, Blomfield St., LONDON, E.C.

COOKING AND HEATING BY GAS,
BY
MAGNUS OHREN, A.I.C.E.

NEW AND REVISED EDITION.
Prepared for Gas Companies to circulate amongst their gas consumers.
£1 per 100; £3 15s. per 500; or £6 per 1000.
Address, MAGNUS OHREN, Gas-Works Lower Sydenham, London, S.E.

COST PRICE SHEETS.

MANUFACTURE AND DISTRIBUTION OF GAS. These sheets are the same as were laid before the Dublin Meeting of the British Association of Gas Managers; but in the REPRINT, NOTES have been added for the guidance of those using them. Copies of the two sheets may now be had, price 5s.
South Shields, January, 1873. W. J. WARNER.

THE Advertiser is desirous of obtaining the MANAGEMENT of a Gas-Work. He has had over 20 years experience in the construction and management of the same, and would have no objection for a part of his remuneration to be dependent upon the profits. Good testimonials.
Apply to E. S., 46, Prospect Street, HULL.

PUPIL WANTED.

THE Advertiser is open to take a Youth about 16 or 17 years of age as an ARTICLED PUPIL. He would have good opportunities of acquiring a thorough knowledge of the management and erection of both Gas and Water Works.
For terms, &c., apply to T. A. DREW, Engineer and Manager, Gas and Water Works, WIDNES.

TO RETORT SETTERS.

A Gas Company will shortly be in want of a RETORT SETTER, who will be required to set and repair all the retorts, and do the general bricklaying on the works. Constant employment will be found. None but thoroughly competent persons, or yet contractors, need apply.
Apply, by letter, to POSTULATA, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BRITISH
ASSOCIATION OF GAS MANAGERS.

ANNUAL MEETING OF MEMBERS

CIRCULAR OF ARRANGEMENTS.

THE TENTH ANNUAL GENERAL MEETING

OF THE MEMBERS OF THIS ASSOCIATION WILL BE HELD ON

TUESDAY, WEDNESDAY, & THURSDAY, the 10th, 11th, & 12th of June, 1873.

Conjointly with the Twelfth Annual General Meeting of the North British Association of Gas Managers, who have expressed a desire to become amalgamated with the British Association,
AT THE

QUEEN STREET HALL, EDINBURGH.

A. ANGUS CROLL, ESQ., A.I.C.E., PRESIDENT,
Will occupy the Chair.

ORDER OF PROCEEDINGS.

TUESDAY, JUNE 10, 1873.—Morning Meeting.

The Chair to be taken at Eleven o'clock.

Inaugural Address by the President. | Admission of New Members.
Reading of Papers and Communications.

Evening Meeting.

Conversazione in the University Industrial Museum. Doors open at Seven o'clock.
Lecture by Dr. STEVENSON MACADAM, F.R.S.E., F.C.S., &c., &c., "On the Physico-Chemical Properties of Gases," with Experimental Illustrations, at Eight o'clock, in the Hall attached to the Museum.

WEDNESDAY, JUNE 11, 1873.

The Chair to be taken at Eleven a.m.

Reading of Papers and Communications, and the Transaction of other Business.
Election of Officers for ensuing Year, &c.
At Seven o'clock the Members and Friends will attend a Banquet at the Masons Hall, 98, George Street, Edinburgh, to be given by friends in Scotland in honour of the Meeting of the two Associations.

THURSDAY, JUNE 12, 1873.

Excursion by Rail from Edinburgh, *viâ* Falkirk, to Cowlairs and Helensburgh; thence by Steamer up Loch Long. Cross from Arrochar to Tarbet on foot. Luncheon at Tarbet Hotel. Return by Steamer down Loch Lomond to Balloch, and by Railway, *viâ* Stirling, to Edinburgh. This excursion is, however, liable to be varied to suit contingencies.
Mr. Foulis, the Engineer of the Glasgow Corporation Gas-Works, has also kindly consented to allow Members to inspect the very extensive new Works at Maryhill, now in course of construction.

LIST OF PAPERS AND COMMUNICATIONS
TO BE SUBMITTED TO THE MEETING.

Report of Committee on the Establishment of a Benevolent Fund.

"The Application of Coffey's Still for the Extraction of Ammonia." By Mr. J. ELDRIDGE, of Richmond.
"Distribution of Gas, and the Importance of having a Complete and Perfect Register of Distributing Plant." By Mr. W. J. WARNER, of South Shields.
"Stoppages in Ascension-Pipes." By Mr. WM. PARLBY, of Aylesbury.
"Coal Wasted in Gas-Works." By Mr. T. H. METHVEN, of Bury St. Edmund's.
"Loss or Unaccounted-for Gas." By Mr. W. B. EMMERSON, of Darlington.
"Gas Street Lighting." By Mr. T. A. SKELTON, of London.
"Coal Gas as a Fuel." By Mr. F. W. HARTLEY, of London.
"Standard Gas-Burners." By Mr. WM. SUGG, of London.
"A Plain System of Book-keeping by Double Entry, specially adapted for Gas Companies." By Mr. J. R. FRITH, of Runcorn.
"Substitutes for Coal in the Manufacture of Illuminating Gas." By Mr. HENRY GORE, of London.
"Computation of Gas Accounts arising from the Non-Registration of Gas-Meters." By Mr. JAMES RANDALL, of Tottenham.
"Gasholder Capacity compared with Consumption." By Mr. R. H. JONES, of Dover.
"A New Compensator and Bye-Pass." By Mr. D. LAIDLAW, of Glasgow.
"Construction and Choice of Materials for Gas Apparatus." By Mr. R. DEMPSTER, of Elland.
"Flow of Gas through Pipes." By Mr. JAMES PATERSON, of Warrington.
Mr. GEORGE ANDERSON, of London, will exhibit Drawings of Apparatus, and give Explanation of their Use for the Purification of Gas from Ammonia, Sulphur, and Carbonic Acid.

In addition to the foregoing, other Papers are in the course of Preparation, which, if completed in time, may be added to the List.

May 24, 1873. WILLIAM H. BENNETT, *Hon. Sec.*

ALF ED WILLIAMS,
PHŒNIX FIRE-BRICK WHARF,
64, BANKSIDE, SOUTHWARK, LONDON, S.E.

GAS ENGINEER AND CONTRACTOR FOR THE ERECTION OF GAS-WORKS,
AND FOR THE
SUPPLY OF RETORTS, FIRE-BRICKS, CAST-IRON MAINS,
AND ALL MATERIALS FOR GAS MANUFACTURE AND DISTRIBUTION.

A Secretary is wanted by a Gas and Water Company, where the consumers number about 400 in each department. He will have to keep all the accounts of the Office, take the superintendence of the Works, and have a knowledge of gas-fitting and plumbing. Security required. A good residence, with gas and coals found, at the Offices in the town.

Address, with references, stating salary required and other particulars, to the DIRECTORS, Gas and Water Company, ALDERSHOT.

TO GAS ENGINEERS, MANAGERS, ACCOUNTANTS, AND OTHERS.

THE Advertiser, having had seven years practical experience in the manufacture and distribution of gas, and all matters connected therewith, including main-laying and gas-fittings, use of test apparatus, also office work and collecting, desires a RE-ENGAGEMENT in any suitable capacity. Unexceptionable testimonials.

Address R. Y. S., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO BE DISPOSED OF, in consequence of being replaced by larger ones, a pair of 6 H.P. VERTICAL ENGINES, with oscillating cylinders, and a pair of 20,000 feet per hour Rotary Exhausters, with all valves and connexions.

Also 28 15-in. D Mouthpieces and Ascension-Pipes to suit.

The above are in good condition, and will be sold together or separately.

Apply to W. C. WATSON, Engineer, Gas-Works, KINGSTON-ON-THAMES.

TO BE DISPOSED OF, in consequence of being replaced by larger ones, about 10 tons of OVAL FLANGED PIPES, 7 in. by 5 in., 6 ft. lengths, and equal to new.

For further particulars, apply to EDWARD PRICE, Engineer to the Hampton Court Gas Company, Works, HAMPTON WICK-ON-THAMES.

TO BE DISPOSED OF, at the Newport (Isle of Wight) Gas-Works—

A 6-in. pipe CONDENSER, consisting of 32 pipes, with syphon-boxes, &c., complete.

36 Circular MOUTHPIECES, 14 in. diameter.

Several lengths of Circular HYDRAULIC MAINS, 14 in. diameter.

BRIDGE-PIPES, 6-in. VALVES.

Which will be disposed of on very moderate terms.

Further particulars can be obtained on application to the MANAGER, Newport, ISLE OF WIGHT.

May 31, 1873.

TO LIGHTERMEN, WAREHOUSEMEN, AND OTHERS.

FOR SALE, two capacious Iron Barges, to carry 85 tons each; very useful for carrying corn, or for general dock work. May be seen at the Phœnix Gas-Works, Greenwich.

For particulars, apply to Mr. P. J. WATES, the Engineer, at the works.

May 26, 1873.

FOR SALE—Several Gas-Works com- plete, from 100 to 2000 lights.

Also PURIFIERS, 4 ft. by 2 ft. 0 in. by 2 ft. 6 in.
" 5 ft. " 2 ft. 6 in. " 2 ft. 6 in.
" 6 ft. " 3 ft. 0 in. " 2 ft. 6 in.
" 6 ft. " 4 ft. 0 in. " 2 ft. 6 in.
" 6 ft. " 6 ft. 0 in. " 3 ft. 0 in.
" 8 ft. " 8 ft. 0 in. " 3 ft. 6 in.

In stock. Can be forwarded on receipt of order.

W. C. HOLMES AND CO.

Whitestone Iron-Works, Huddersfield.

May 26, 1873,

TO BE SOLD, ready for immediate delivery, Two 60,000 per hour BEALE'S EXHAUSTERS, with outer bearings. One 20,000 per hour BEALE'S EXHAUSTER, with inlet and outlet valves, shaft, and coupling complete. All in good condition, equal to new.

Apply to G. WALLER AND CO., Phœnix Engineering Works, Holland Street, SOUTHWARK, S.E.

STATION-METERS.—Two Second-Hand FOR SALE—one passing 3000 feet per hour, the other 3500 feet per hour; both in excellent condition. Also one set 5-in. HYDRAULIC VALVES and Bye-Pass.

Apply to W. and B. COWAN, King Henry's Walk, Balls Pond Road, LONDON, N.; or Buccleuch Street Works, EDINBURGH.

THE Dundalk Gaslight Company, Limited, have for SALE Four PURIFIERS and one 8-in. CENTRE-VALVE with connexions. Two of the purifiers are 8 ft. 4in. by 2 ft. 9 in.; the others are 5 ft. square, same depth. The above are about to be removed to make room for others of larger dimensions, and will be ready for delivery in June next. They will be sold together or separately.

For price and particulars apply to T. SHIELD, Manager.

SALISBURY GASLIGHT AND COKE COMPANY.

PERSONS desirous of contracting for the purchase of the TAR made by the Salisbury Gaslight and Coke Company for Twelve months, from the 30th of June next, are requested to send TENDERS, addressed to Mr. Hardick, at the Gas-Works, Fisherton Anger, Salisbury, on or before the 16th of June.

For any further particulars application may be made to Mr. Hardick, at the works.

The Close, Salisbury, E. E. S. KELSEY, Secretary.

May 21, 1873.

THE Directors of the Wareham Gas and Coke Company are prepared to receive TENDERS for the supply of 300 tons of Pelaw Main, North Pelton, or Brancepeth GAS COALS (best quality), to be delivered free of charge into lighters, at Russell Quay, by the 20th of August next.

Payment will be made for the same two months from the time of delivery.

The Directors reserve the right to refuse all or any of the Tenders.

Tenders to be sent to my office on or before the 19th of June, 1873. F. FILLITER, Secretary.

North Street, Wareham, Dorset, May 19, 1873.

THE MALTA & MEDITERRANEAN GAS COMPANY, LIMITED.

NOTICE is hereby given that the ORDINARY GENERAL MEETING of the SHAREHOLDERS of this Company will be held at the London Tavern, Bishopsgate Street, on THURSDAY, the 19th of June next, at Twelve o'clock at noon precisely, for the purpose of receiving the report and accounts for the year ended the 31st of March, 1873; the declaration of a dividend; and the transaction of the general business of the Company.

Two of the Directors—namely, Robinson Duckworth, Esq., and John Romanes, Esq.—will retire from office, but are eligible for re-election.

The Transfer Books will be closed from the 12th of June next until after the Meeting.—By order of the Board,

E. P. ROWSELL, Secretary.

60, Gracechurch Street, E.C., May 30, 1873.

THE IMPERIAL CONTINENTAL GAS ASSOCIATION.

The HALF-YEARLY ORDINARY MEETING of the Imperial Continental Gas Association was held at the City Terminus Hotel, Cannon Street, London, on TUESDAY, the 27th inst.,

PHILIP TWELLS, Esq., the Chairman,

when the following Resolutions were passed:—

Resolved unanimously—"That the report upon the affairs of the Association now read be received, adopted, and entered on the minutes."

Resolved unanimously—"That a dividend of £2 per share be declared upon the 56,000 shares of the Association, for the half year ended the 31st of December last; and that the said dividend be payable, free of income-tax, on and after Monday, the 16th of June next."

Resolved unanimously—"That Henry Wood, Esq., be re-elected a Director of the Association."

"That John Wilkin, Esq., be re-elected a Director of the Association."

"That Nathaniel Montefiore, Esq., be re-elected a Director of the Association."

"That Joseph Sebag, Esq., be re-elected an Auditor of the Association."

"That the cordial thanks of the meeting be given to the President and Directors for their able management of the affairs of the Association, and to the Chairman for his conduct in the chair this day."

Upon the motion of the Chairman (Mr. Philip Twells), a vote of thanks was also given to Mr. G. W. Drory, the General Superintendent of the affairs of the Association on the Continent, and to the agents and the other officers acting under him.

By order of the Board of Direction,

ALBERT F. JACKSON, Secretary.

30, Clement's Lane, Lombard Street,
London, May 28, 1873.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee of the Buxton Local Board desire to receive TENDERS for the supply of 1000 tons of GAS COAL and 800 tons of CANNEL, to be delivered on their siding at the Midland Railway Company's Station, Buxton, during Twelve months, from the 31st day of August next, as from time to time directed by their Manager. They are to be as free as possible from sulphur, bats, bind, and refuse.

Tenders to be addressed to the Chairman of the Gas Committee (endorsed "Tenders for Gas Coal") on or before the 11th day of June inst.

By order of the Committee,
Buxton, May 27, 1873. GEO. SMEDLEY, Manager.

TO TAR DISTILLERS, &c.

THE Directors of the Kingston-upon- Thames Gas Company are prepared to receive TENDERS for the surplus TAR produced at their works at Kingston, from July 1, 1873, to June 30, 1874. Quantity about 80,000 gallons. Tenders to be at per gallon f.o.b. the Contractor's barge.

Further particulars may be obtained from Mr. Watson, Manager, at the works.

Tenders to be sent to Mr. W. A. Fricker, Secretary, Gas Offices, Church Street, Kingston, on or before the 24th of June inst., endorsed "Tender for Tar."

The Company do not pledge themselves to accept the highest or any tender. By order,

W. A. FRICKER, Secretary.

Gas Offices, Kingston, June 2, 1873.

CITY OF ELY LOCAL BOARD OF HEALTH.

LIGHTING WITH GAS.

NOTICE is HEREBY GIVEN that the Local Board of Health for the district of the City of Ely will be prepared at their MEETING, which will be held at the Grand Jury Room, in the Shire Hall, in Ely, on WEDNESDAY, the 18th day of June next, at Twelve o'clock at noon, or at some adjournment thereof, or at some subsequent Meeting or adjournment thereof, to enter into a CONTRACT for a period of Three years from the 15th day of August next (but determinable at the end of the first or second year at the option of the Local Board of Health on giving three calendar months notice) with any Company or person for LIGHTING WITH GAS the Streets, Roads, and other open places, Markets, and Public Buildings situate within the said district, or such and so many of them as they may from time to time appoint or determine.

And NOTICE is hereby further given that any Company, person, or persons willing to undertake the same are invited to make proposals, or send in TENDERS for that purpose at the aforesaid Meeting.

N.B.—The present number of Public Lights is 126, or thereabouts; the annual season for lighting will be from the 15th day of August to the last day of May inclusive in each year. The lamps are to be lighted within half an hour of sunset, and extinguished not earlier than two hours before sunrise, with liberty to omit lighting the night before and the night of full moon. The quantity to be supplied to each lamp to be at the rate of 4½ cubic feet of gas per hour, and the quality to be what is commonly called 14-candle gas.

The Local Board require that all tenders sent in shall state the gross sum per public light per annual season for which the Company, person, or persons will undertake to light the same, inclusive of the expense of lighting, extinguishing, cleaning, painting, and repairs.

The Company, person, or persons whose tender is accepted, will be required to enter into a Contract with the Local Board, containing stipulations as to the quantity of gas to be supplied to each burner, the pressure, the quality and the testing thereof, the penalties for non-lighting, the addition of new lights, &c., &c., a copy of which can be seen on application to the Clerk.

The Local Board do not bind themselves to accept the lowest or any tender.—By order of the Board,

Ely, May 22, 1873. WM. MARSHALL, Clerk.

THE NEW GAS COMPANY, LIMITED.

THE Directors of the above Company are ready to receive APPLICATIONS from owners of existing Gas-Works, as well as from others erecting or about to erect new works, and to grant Licences for the use of the Patents.

Apply to the SECRETARY, 22, WALBROOK, E.C.

TO IRONFOUNDERS AND OTHERS.

THE Falmouth Gas Company are pre- pared to receive TENDERS for the Supply and Erection on their works of a CAST-IRON SCRUBBER, in accordance with plans and specification, which may be seen at the Company's Offices, Church Street, Falmouth.

Sealed tenders, endorsed "Tender for Scrubber," to be sent to the Office not later than Monday, the 9th of June next.

The Company do not bind themselves to accept the lowest or any tender. R. J. LUKEY, Secretary.

Falmouth May 28, 1873.

TENDER FOR GAS COAL.

THE Directors of the Tonbridge Gas Company are prepared to receive TENDERS for the supply of 1800 tons of best GAS COAL, to be delivered at their works in the following order:—

200 tons	first week in	August	next.	
200	"	"	September	"
200	"	"	October	"
400	"	"	November	"
200	"	"	January,	1874.
200	"	"	February	"
200	"	"	March	"
200	"	"	June	"

Tenders to be addressed and sent to the Secretary of the Company at Tonbridge, on or before the 21st of June, to state the name and description of the Coal, and to be endorsed "Tender for Gas Coal."

The Directors do not bind themselves to accept the lowest or any tender.

Dated May 30, 1873.

BOLTON CORPORATION.—GAS DEPARTMENT.

CONTRACTS FOR CANNEL AND COAL.

THE Gas Committee of the Bolton Cor- poration are desirous of receiving TENDERS for 5000 tons of CANNEL, and 3000 tons of best GAS COALS or NUTS. The whole to be delivered annually for a term of Two, Three, or Five years, in such monthly quantities as may be required by the Gas Engineer, at the Bullfield or Craddock Lane sidings of the Lancashire and Yorkshire Railway Company, or, if carted, to be delivered at the Lum Street or Gas Street Works.

The contracts to commence on the 1st of July this year.

The Cannel and Coal to be the best of their kind, and to be as free as possible from sulphur, blend, refuse, and dirt, and to be well screened.

Sealed tenders, endorsed "Tender for Cannel," &c., specifying the Description of Cannel and Coal, the pits at which they are to be raised, and the quantities proposed to be supplied, to be sent to the undersigned, on or before Saturday, the 14th of June next, stating also the cash terms for monthly payments.

The Committee do not bind themselves to accept the lowest or any tender; but the person or persons whose tender may be accepted will be required to execute an agreement for the due performance thereof.—By order,

E. G. HEDNELL, Town-Clerk.

Gas Offices, Bolton, May 30, 1873.

REMOVAL.

MR. ALFRED PENNY, C.E., begs to give notice that he has REMOVED his Offices from the Wenlock Iron-Works to No. 30, ABINGDON STREET, WESTMINSTER, where he may be consulted as usual on all matters connected with Gas-Works, Water-Works, and Drainage, both for England and Abroad.

CLAYTON'S PATENT SIX-WAY VALVE only requires one valve to work two purifiers; saves more than three-fourths of the connexion-pipes; requires neither tees, elbows, nor bends; no racks or springs to get out of order.

For particulars, apply to CLAYTON, SON, & Co., Gas Engineers, Hunslet, LEEDS.

THE PATENT RIBBED GAS RETORTS are strongly recommended for their efficiency and great durability. They are in use at above 150 Gas-Works.

Illustrated circular, testimonials, and prices, will be forwarded on application to

A. C. FRASER,

PATENT GAS COMPANY, GAS-WORKS, NEW BARNET, HERTS.

OXIDE OF IRON.— We are prepared to supply, on moderate terms

HYDRATED PEROXIDE OF IRON (BOG OCHRE),

Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.

FRANCIS RITCHIE & SONS,
BELFAST.

TORBANEHILL MINERAL.

For Sale, by Tender,

FOR WHOLE OR PART,

SEVERAL THOUSAND TONS OF THE

Celebrated Torbanehill Mineral,

Saved from the fire at Torbanehill in June last.

The mineral as it at present lies has been examined and analyzed by Dr. WILLIAM WALLACE, Analytical Chemist, Glasgow, who says:

"Very great care was employed to obtain reliable average samples, and the results show that the mineral is not appreciably damaged."

The results of two testings of fair samples of the Coal give 14,080 cubic feet of 43·7 candle gas.

APPLY TO

MR. DAVID STEWART,

128, INGRAM STREET, GLASGOW.

BAILEY'S Patented Inventions are now in extensive use wherever steam is known. Bailey's Patent Steam Gauges, Pyrometers, Water Gauge Cocks, Test Pumps, Fusible Plugs, Steam and Water Valves, Safety Valves, Junction Valves, Pumps, Tell-Tales, Recorders, Lightning Conductors, Electric Telegraphs, Turret Clocks, Steam Joint Cement, Lifting Jacks, Boiler Feeders, Lime Catcher and Separator, Injectors and Ejectors, and every description of first-class Brass Work for Engines and Boilers. Gas-Works Managers who have not our large book should send for it.

16th edition, 1000 engravings, 4to., post free 2s. in stamps, weight 10 oz., cost of production £1000,

BAILEY'S Illustrated Inventions, containing details and prices of goods in our five several departments:—(1) Brass Foundry, Steam Gauges, Indicators, Feeders, and Fittings; (2) Engineers Sundries, Small Tools, and Stores; (3) Machine Pump and Fire Engine; (4) Turret Clock, &c.; (5) Electric Telegraph, A B Instruments, Bells, and Apparatus.

J. BAILEY and Co., Albion Works, Salford, LANCASHIRE.

ROBERT MACLAREN and CO., EGLINTON FOUNDRY, GLASGOW, Manufacturers of all sizes of Cast-Iron Main-Pipes by an improved Patent, General Ironfounders, Gas Engineers, and Wrought-Iron Tube Makers.

DEMPSTER'S
RENOWNED
WOOD SIEVES,
WITH TAPER BARS,
MADE BY MACHINERY
CAPABLE OF MAKING 10,000 FEET WEEKLY.
References to Hundreds of First-Class Engineers.
ROSE MOUNT IRON-WORKS,
ELLAND, NEAR HALIFAX.

CLOTH GAS-BAGS FOR MAINS,

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather, India-Rubber and Gutta-Percha Machine-Bands, Sheet and Washers for Steam Joints.

T. BUGDEN, Manufacturer,
79, GOSWELL ROAD, LONDON, E.C.

THE PATENT
CATOPTRIC LAMP
for Streets and all Situations where the Light ascending above the level of the Lamp is wasted,
Is now in use in Moorgate St., London, and has been in successful operation upon Waterloo Bridge since Oct. 7, 1871.
T. A. SKELTON, 37, Essex St., Strand, LONDON,
INVENTOR AND PATENTEE.

EVERY DESCRIPTION
OF
GAS COAL AND CANNEL
SUPPLIED BY
E. FOSTER & CO.,
COAL and CANNEL
MERCHANTS,
21, JOHN STREET, ADELPHI,
LONDON, W.C.

Prices Quoted on application.

GAS AND WATER PIPES.

WILLIAM MACLEOD & CO.,
METAL MERCHANTS AND CONTRACTORS
18 & 20, ALSTON STREET, GLASGOW.

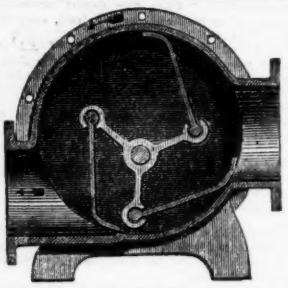
CAST-IRON GAS AND WATER PIPES AND FURNISHINGS.
MALLEABLE IRON TUBE FOR GAS, WATER, AND STEAM.
AGENTS FOR THOMAS GLOVER & CO.'S
PATENT DRY GAS-METERS
DELIVERY F.O.B. ON CLYDE.
Lists on application.

COLLIERY OFFICE, STOURBRIDGE.

SCARCITY OF COALS!!!

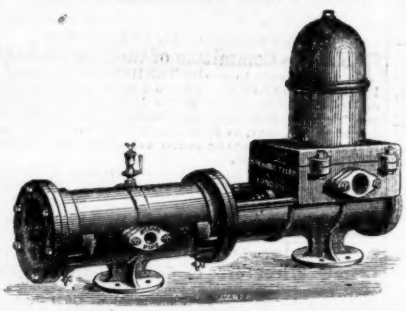
G. J. EVESON has on offer large quantities of CANNEL COAL and ordinary GAS COAL for immediate delivery to any part of England. Rates and prices on application.

G. J. EVESON,
COLLIERY OFFICE, STOURBRIDGE.
GAS COKES TAKEN IN ANY QUANTITY IN RETURN WAGGONS, OR WAGGONS SPECIALLY SENT.



CHARLES HORSLEY'S
PATENT
GAS EXHAUSTER.
(From 250 Feet upwards per Hour.)
Also,
ROTARY TAR AND OIL PUMPS.
For particulars and prices apply to the Patentee,
22, Wharf Road, City Road, London, N.

THE PATENT
"UNIVERSAL" STEAM PUMP.

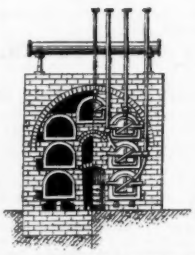


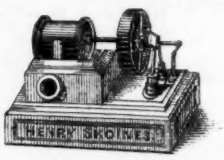
SOLE MAKERS,
HAYWARD, TYLER, & CO.,
84 & 85, UPPER WHITECROSS STREET, LONDON, E.C.
IN USE IN SOME OF
THE PRINCIPAL GAS-WORKS IN LONDON, SHEFFIELD, PENISTONE, &c.,
FOR
TAR AND AMMONIACAL LIQUORS.

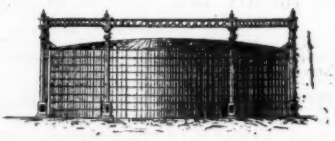
Ardwick Bridge Chemical Works, Manchester, Oct. 28, 1872.

Sir,—The "Universal" Steam Pump obtained from you, and which has been employed during the last six months pumping caustic soda at these works, still continues working satisfactorily.—Yours truly,
(Signed) PETER HART, *Manager.*

HENRY SKOINES,
CONTRACTING GAS ENGINEER
FOR
SETTING RETORTS,
ERECTING AND REMODELLING GAS-WORKS
OF ANY EXTENT, AT HOME AND ABROAD.
RETORTS RESET, and the whole or any portion of Gas Apparatus supplied to the Trade, with their choice of name and device, if desired.







7, ARGYLE STREET, KING'S CROSS.

JOSEPH AIRD,
WELLINGTON

TUBE-WORKS,
GREAT BRIDGE, TIPTON,
STAFFORDSHIRE,
MANUFACTURER OF
PATENT WELDED WROUGHT-IRON TUBES AND FITTINGS.

JAMES MILNE & SON,

GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

EDINBURGH, AND

2, KING EDWARD STREET,

NEWGATE STREET, LONDON.

STATION-METERS, GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,

And every description of Gas-Fittings and Gas Apparatus.

SCHOLL'S

PATENT PLATINUM

GASLIGHT PERFECTER.

Extract from Report by Dr. Letheby:—

"The results have been very remarkable, for they show an average increase of 63 per cent. on the illuminating power of the gas. I am of opinion, therefore, that the invention is of great practical value."

Extract from Dr. Frankland's Course of Lectures at the Royal School of Mines, February, 1868.

"Scholl's Platinum Perfecter is one of the most important inventions of modern times in connexion with the burning of coal gas."

Price 1s. each for Fishtail Burners.

To be had retail of Gas-Fitters and Ironmongers.

JOHN SCHOLL, Manufactory: 41 & 42, BERWICK STREET;

Retail Depot: 198a, OXFORD STREET, LONDON, W.

Terms on application. N.B.—A specimen sent free on receipt of Twelve stamps.

*** Further testimonials from Drs. Frankland and Crooks, showing the great practical value of this invention, will be shortly published.

CANNEL COAL.

ELLIS LEVER & CO.,

GAS COAL MERCHANTS,

107, PICCADILLY, MANCHESTER.

ALL CLASSES OF

ENGLISH, SCOTCH, & WELSH CANNEL COALS.

SAM. CUTLER & SONS,

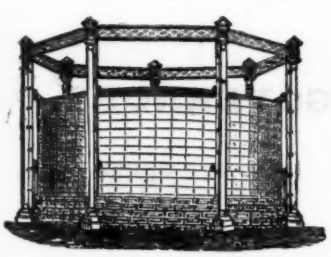
CONTRACTING GAS ENGINEERS,

GASHOLDER & GENERAL GAS APPARATUS MAKERS,

MANUFACTURERS OF

BOILERS, IRON ROOFING, IRON BRIDGES,

AND GENERAL IRONWORK.



S. C. AND SONS undertake Contracts of any magnitude for the **Erection of new and Remodelling of existing Gas-Works**, for **Gasholders, Cast and Wrought Iron Tanks, Iron Roofs**, and every description of **Apparatus** for the Manufacture and Distribution of Gas.

Special attention is invited to their **"Improved Condenser,"** which is very effective, and much approved; also to their patterns of **Annular** and other **Condensers, Scrubbers**, and **Purifiers**, of all sizes, which they arrange either with **Centre** or Ordinary **Slide Valves.**

WORKS FOR THE SUPPLY OF

VILLAGES, MANSIONS, FACTORIES, &c.

S. C. AND SONS undertake the **Supply** and **Laying** of **Mains** for **Gas and Water**, and supply all Castings, Connexions, and Fittings for Retort-House, Works generally, and for Streets. They also supply **Valves** of all descriptions, Iron and Clay Retorts, Hotpressed Retort-Lids, Steel Charging-Scoops of improved make, for which they have special machinery, Improved Coke and Coal Barrows, Cross-Bars and Screws, Bolts and Nuts, Furnace and Stoking Tools, Iron and Wood Purifier-Sieves, Lead, Yarn, Borings, &c., including every requisite whatsoever for a Gas-Work, a well-assorted stock being kept of those goods most in request.

SOLE MAKERS OF BRETT'S PATENT COKE BARROW.

Experienced Retort Setters sent to any part of the Kingdom.

Address: PROVIDENCE IRON-WORKS, MILLWALL, LONDON.

B. CARPENTER'S

IMPROVED WOOD SIEVES

FOR

GAS PURIFIERS & SCRUBBERS.

WORKS:

22, HERMES STREET, PENTONVILLE ROAD,

LONDON, N.

The above Sieves are used by all the Gas Companies in London and a great many in the country. Their utility, durability, and cheapness combined, render them superior to all others.

Testimonials from Gas Engineers who have tested their qualities forwarded on application.

All orders punctually attended to, and estimates given if required.

INTERNATIONAL EXHIBITION, 1862.

CLASS X.

PRIZE MEDAL

For excellence of Fire-Clay Gas Retorts, and

"HONOURABLE MENTION" for good quality of Fire-Bricks.

WILLIAM STEPHENSON & SONS,

THROCKLEY,

NEWCASTLE-ON-TYNE.

THOMAS EDINGTON & SONS,

PHŒNIX IRON-WORKS,

GLASGOW,

MANUFACTURERS OF

GAS AND WATER PIPES,

All sizes up to 4 ft. diameter;

RAILWAY CHAIRS AND SLEEPERS, and general Castings. Also

GREGORY'S & COCKBURN-MUIR'S

PERMANENT WAY.

London Office: 63, OLD BROAD STREET, E.C.

J. T. B. PORTER & CO.,

GAS ENGINEERS,

MANUFACTURERS AND CONTRACTORS FOR GAS-WORK

Of any extent at Home and Abroad,

GOWTS BRIDGE WORKS, LINCOLN,

AND

1, WESTMINSTER CHAMBERS, VICTORIA STREET, S.W.

BRONNER'S PATENT GAS-BURNERS give 99 per cent. of light, as compared with 27 per cent. given by ordinary burners, with equal consumption of gas.—*Vide* "Gas Referees Report," published June, 1869.

HENRY GREENE AND SON, Sole Consignees of Brönner's Patent Improvements in Gas Lighting, 16 and 17, King William Street, LONDON, E.C.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & CO., GHENT, will receive immediate attention.

CATHELS & TERRACE'S Patent Four-WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, Foundry and Brass Works, ROTHERHAM.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

ADDISON POTTER,

WILLINGTON QUAY,

NEAR NEWCASTLE-UPON-TYNE,

Manufacturer of Clay Retorts, Fire-Bricks and every description of Fire-Clay Goods.

TO GAS COMPANIES, ENGINEERS, &c.

WOOD SIEVES.—WOOD SIEVES.

Estimates given and Contracts taken by the Manufacturer

GEORGE MACKANESS,

36, EDWARD STREET, HAMPSTEAD ROAD,

LONDON, N.W.

These Sieves are made with parallel or bevel bar, and guaranteed to be well seasoned yellow deal, and not common spruce so generally used.

N.B.—Specimens sent free on application.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 20 & 22, WHARF ROAD,

CITY ROAD, LONDON, N.,

Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including Iron Retorts, Socket and Flange Pipes, Bends, Branches, and Syphons of all sizes, Lamp Columns, &c., &c.

N.B.—Orders for Cast-Iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention. CHARLES MORSLEY, Agent.

THE IMPERIAL METER COMPANY, LIMITED,

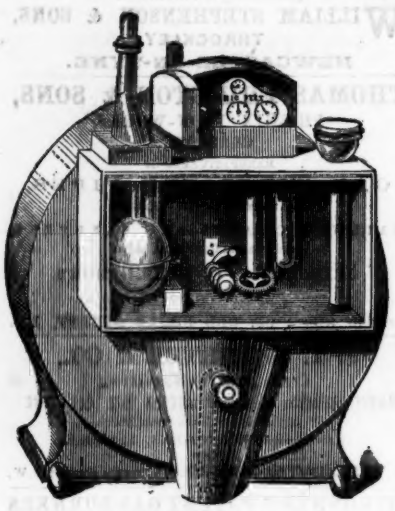
MANUFACTURERS OF

WET AND DRY GAS-METERS,

PRESSURE-GAUGES AND GOVERNORS, AND STREET-LAMP REGULATORS.

FACTORIES:

KING'S ROAD, LONDON, N.W., and GRAY'S INN ROAD, LONDON, W.C.



Front View.

THE

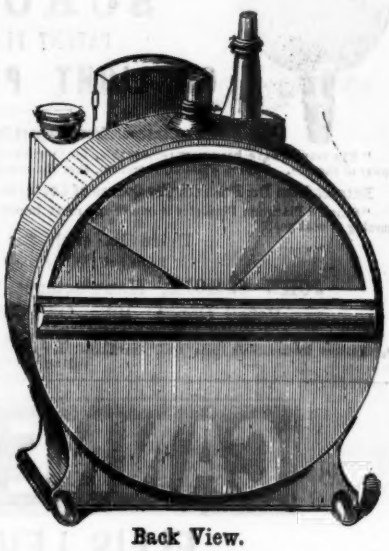
IMPERIAL

COMPENSATING

WET GAS-METER.

DE CASTRO & BURTON'S

PATENT.



Back View.

I. **This Meter is more simple in construction than the common non-compensating Meter.**
II. **An unvarying water-line is maintained.**
III. **No amount or kind of pressure will cause it to "flood."**
IV. **It is practically unaffected by "tilting."**
V. **The friction is less than in any other Meter; and**
VI. **It will last for twelve months without requiring to be refilled.**

THE IMPERIAL METER COMPANY, LIMITED, ALSO MANUFACTURE COMMON NON-COMPENSATING WET GAS-METERS OF ALL SIZES, BOTH IN TIN AND CAST-IRON CASES.

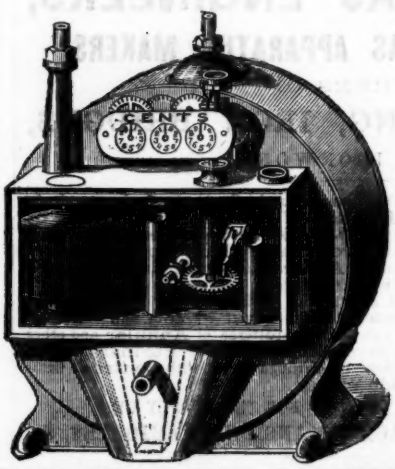
THE COMPENSATING

WET GAS-METER

IS UPHELD FOR

TEN YEARS

WITHOUT CHARGE.



THE IMPERIAL WET GAS-METER.
Non-Compensator.

STATION-METERS

WITH PLANED JOINTS,

AND

GOVERNORS,

MADE TO ORDER.

Mr. GEORGE MACKANESS will represent this Company in the Provinces.

OFFICES: 41, FLEET STREET, LONDON, E.C.

W. MOORE, Secretary.

☞ *All Communications to be addressed to the Secretary.*

THE IMPERIAL METER COMPANY, LIMITED,

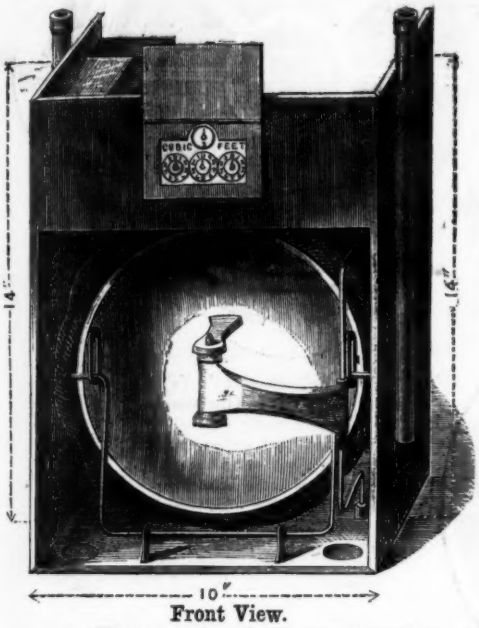
MANUFACTURERS OF

WET AND DRY GAS-METERS,

PRESSURE-GAUGES AND GOVERNORS, AND STREET-LAMP REGULATORS.

FACTORIES:

KING'S ROAD, LONDON, N.W., and GRAY'S INN ROAD, LONDON, W.C.



Front View.

THE

IMPERIAL

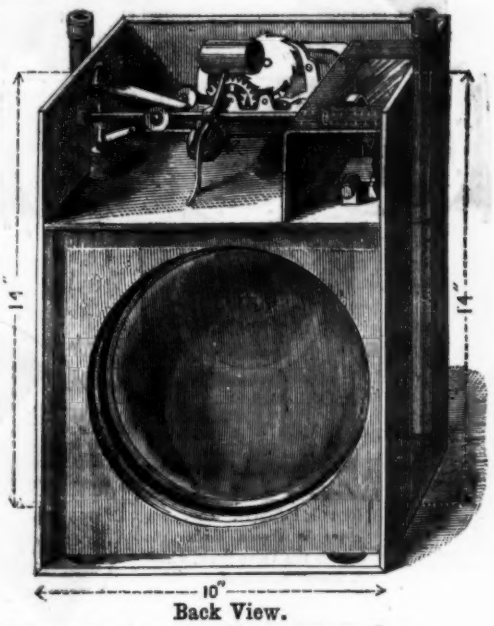
DRY

GAS-METER

SINGLE DIAPHRAGM.

TELLING & JOHNSON'S

PATENT.



Back View.

I. The mechanical construction of this Meter is simpler and stronger than any other.
II. About half as much leather is used as in ordinary dry Meters.
III. The Meter has only one valve, and this cannot "stick."
IV. The lights maintain perfect steadiness and strength of flame. There is no "draw."
V. The gas consumed can only be measured from the inlet to the outlet, and
VI. The index cannot be made to register backwards.

THE IMPERIAL METER COMPANY, LIMITED, ALSO MANUFACTURE ORDINARY DOUBLE DIAPHRAGM DRY GAS-METERS OF ALL SIZES, BOTH IN TIN AND IN CAST-IRON CASES.

SPECIAL ATTENTION

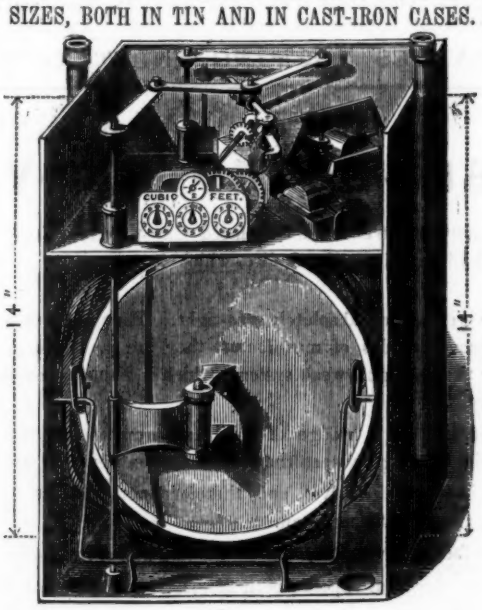
IS PAID TO THE

MANUFACTURE OF

STREET-LAMPS

AND

REGULATORS.



THE IMPERIAL DRY GAS-METER.
Double Diaphragm.

EVERY

DRY GAS-METER

IS UPHELD FOR

SIX YEARS

WITHOUT CHARGE.

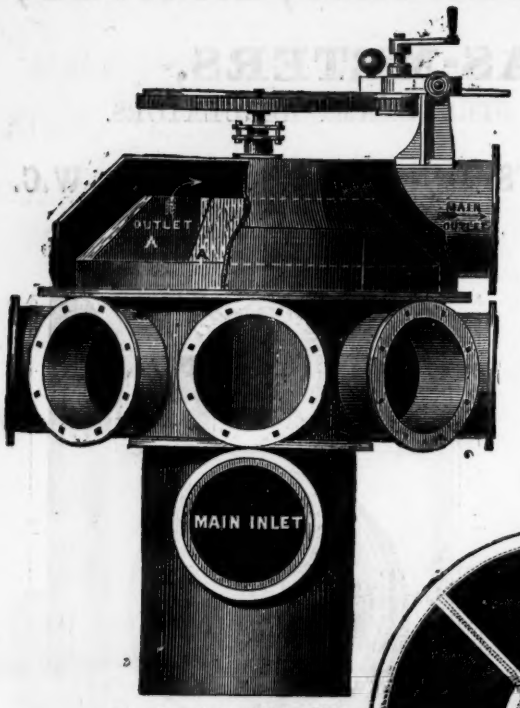
Mr. GEORGE MACKANESS will represent this Company in the Provinces.

OFFICES: 41, FLEET STREET, LONDON, E.C.

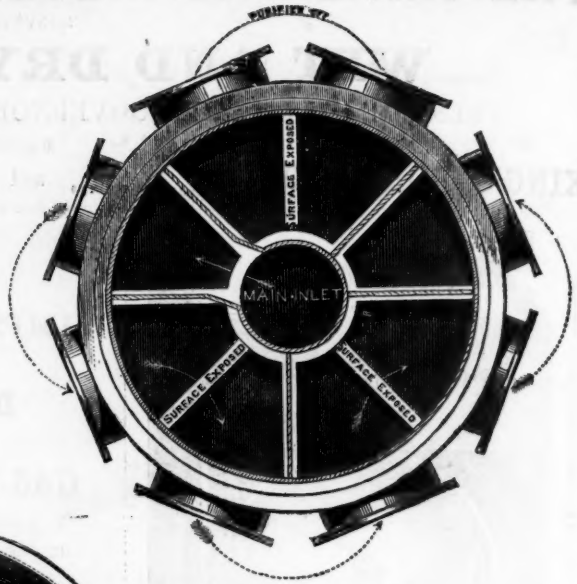
W. MOORE, Secretary.

☞ *All Communications to be addressed to the Secretary.*

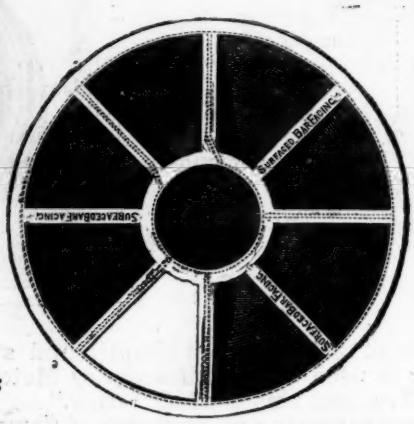
C. & W. WALKERS' PATENT CENTRE-VALVES.



Elevation of the Centre-Valve for four Purifiers. The safety cover is shown broken, to enable the Valve itself, which is inside, to be seen.



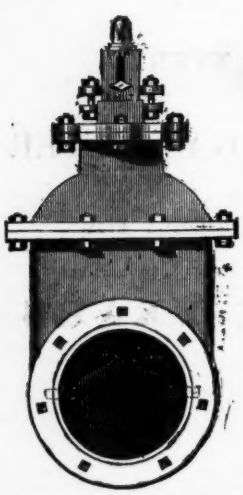
Plan of the Body, showing the Valve lying in it, with three of the facings, which were formerly exposed to settlements of dirt, carbon, naphthaline, &c., but which are now always covered by the surfaced bar-facings of the Valve. (See below.)



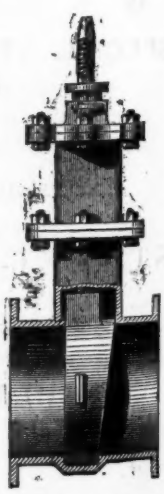
Plan of the Valve, or upper portion, showing the surfaced bar-facings referred to above.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A very considerable improvement and saving is effected in the cost of the connecting-pipes.

FOUR-WAY CENTRE-VALVES FORMING INLET, OUTLET, AND BYE-PASS.



C. & W. WALKERS'
DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves are superseding the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.

GASHOLDERS, TELESCOPE & SINGLE-LIFT, of LARGEST DIMENSIONS.
PURIFIERS, SCRUBBERS, CONDENSERS of most Improved Description.
WOOD SIEVES FOR PURIFIERS,

Which have now been in use for more than ten years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS, DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

WILLIAM & BENJAMIN COWAN,

ESTABLISHED 1827.

KING HENRY'S WALK,
BALLS POND ROAD,
(NEAR DALSTON JUNCTION STATION,) **LONDON, N.**

BUCCLEUCH ST. WORKS,
EDINBURGH.

Manufacturers of DRY GAS-METERS in TIN AND CAST-IRON CASES.

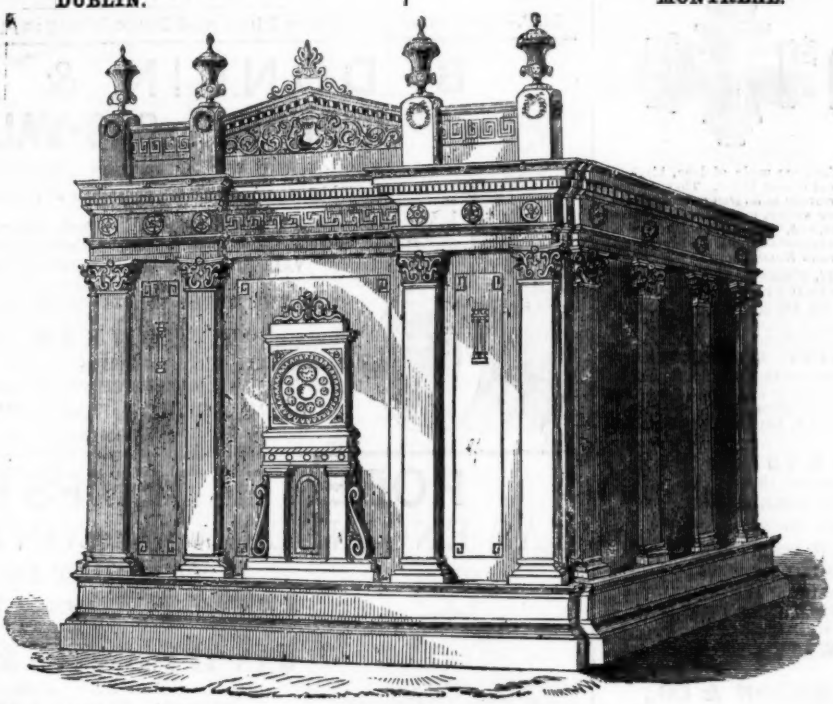
Sole Manufacturers of ESSON'S PATENT COMPENSATING GAS-METER,

AND OF **COWAN'S PATENT SIDE-VALVE GAS-METER.**

AGENTS.

Messrs. J. EDMUNDSON & Co., 36, Capel Street, DUBLIN.

Messrs. R. MITCHELL & Co., Peter Street and Craig Street, MONTREAL.



W. & B. COWAN'S SQUARE STATION-METER with PLANED JOINTS.

GOVERNORS, PRESSURE REGISTERS, TEST GASHOLDERS, GAUGES, &c.
WET AND DRY METERS SPECIALLY MANUFACTURED FOR STREET-LAMPS.

PRICE LISTS ON APPLICATION.

Mr. ALFRED LASS,
60, CORNHILL, LONDON, E.C.,

Is prepared to open the Books, and, if necessary, keep the Accounts of Gas and Water Companies.

To examine the Books and Accounts, and prepare Balance-Sheets for the information of Directors.

To assist Secretaries in preparing Balance-Sheets, according to the "Gas-Works Clauses Act, 1871;" or may be consulted with respect to Accounts generally.

SAMUEL PONTIFEX, Consulting Gas Engineer, having retired from the Great Central Gas Company, is now prepared to furnish PLANS and SPECIFICATIONS, as well as ADVISE Provincial Gas Companies as to the erection of new, or alteration and enlargement of existing works.

Offices: 22, Coleman Street, LONDON, E.C.

J. T. B. PORTER & A. SILVERTHORNE, C.E., 1, Westminster Chambers, LONDON, S.W., Consulting Engineers.

Corporations and Companies advised on all matters connected with Gas and Water Works.

BIRTLEY IRON WORKS,
CHESTER-LE-STREET,
DURHAM.

Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Agent in London, Mr. J. MANWARING, 101 Cannon Street E.C.

WILLIAM BRODIE & CO.,
GAS ENGINEERS,
MANUFACTURERS AND CONTRACTORS FOR
GAS APPARATUS, GASHOLDERS, TANKS, VALVES, IRON ROOFS, GIRDERS, BRIDGES, &c.,
CALEDONIA IRON-WORKS, PAISLEY.

Attention is requested to
BRODIE'S IMPROVED GAS APPARATUS,
Admitted to be the best and most economical for lighting factories, railway stations, mansions, country houses, and other isolated buildings.

FIRE-CLAY RETORTS.

WILLIAM FRASER,
INVERKEITHING,

(Owner of the Works at which Fire-Clay Retorts were first made), can supply
RETORTS, FIRE-BRICKS, &c.,
to any extent.

References can be given to managers of above a hundred Gas-Works whom he supplies.

He ships at Charlestown his
CELEBRATED HALBEATH STEAM COALS,
on Navy List.

EDGE'S PATENT
FOR REMOVING THE
CARBONACEOUS INCRUSTATION FROM GAS-RETORTS.

"*Gas-Works, Stafford, Oct.* 24, 1870.

"My dear Sir,—In reply to your favour just to hand, I have much pleasure in bearing my testimony to the efficiency of Edge's process for removing the carbon from Clay Retorts. It has been in use at these works during the last two years, and so satisfactorily has it done its work that I should be very sorry to be without it.—I remain, my dear sir, faithfully yours,

"JOHN STOKER.

"E. Goddard, Esq."

For particulars and terms, apply to E. GODDARD, Sole Agent, Gas-Works, IPSWICH.

ALEXANDER F. PAINTER,
CONTRACTING ENGINEER
FOR
GAS & WATER WORKS,
GREAT BERKHAMPSTEAD, HERTS.

Foreign Orders carefully executed. Provincial Gas-Works designed and erected. Extensions of Works carried out with despatch. Mains supplied and promptly laid. Public and Private Buildings fitted up. Gasholders, Purifier Covers, and all Sheet Ironwork. Wrought Ironwork to drawing.

Specifications, Estimates, and Tenders given.

GAS-WORKS LEASED.

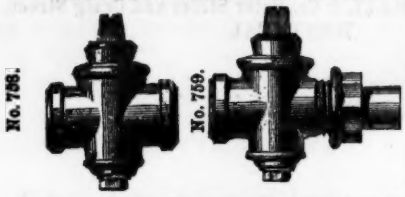
TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE
FIRE CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICK.
Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.
Successors to
E. BAKER AND CO., LATE BRIERLEY HILL, STAFFORDSHIRE.

PRICE'S PATENT COKE & COAL BARROW,

effecting a great saving of time, labour, and expense.
For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.

LAMBERT'S
CAST-IRON GAS-MAIN COCKS,
WITH PATENT WHITE METAL PLUGS.



The bodies of these Taps are made of Iron, black or galvanized, and the Plugs of Patent Metal. They are warranted not to set fast or corrode as do iron or brass Cocks, will always work easily, are strong, well made, durable, of little or no intrinsic value, and, therefore, not likely to be stolen; and the PRICES are (especially upon the larger sizes) FULLY 50 PER CENT. LESS THAN BRASS COCKS.

GAS-JOINTS, CHANDELIERS, PENDANTS, BRACKETS, ETC.; WROUGHT-IRON WELDED TUBE AND FITTINGS, BRASS, COPPER, LEAD, TIN, AND COMPOSITION TUBING,
Stocks, Taps, and Dies, and Every Description of Gas-Fitters Tools; Gas Slide and Sluice Valves;
CARTER'S SAFETY GAS-VALVES;
GAS-STOVES, REGULATORS, BURNERS, &c.
Pattern-Book and Price List of Gas-Fittings, supplied on application.
THOS. LAMBERT & SONS, Lambeth, London, S.E.

JAMES NEWTON & SONS,
(Established 1820,)
FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
FALCON DOCK, 78 AND 79, BANKSIDE,
SOUTHWARK, LONDON, S.E.,
DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for
GAS AND WATER WORKS.

WALTER MABON & CO.,
Engineers,
ARDWICK IRON-WORKS,
FAIRFIELD STREET, MANCHESTER,
MANUFACTURERS OF
IRON TANKS, GASHOLDERS,
GAS APPARATUS,
PIPES, VALVES, IRON ROOFS,
WROUGHT AND CAST IRON GIRDERS.

DESIGNS, SPECIFICATIONS, & ESTIMATES FURNISHED.

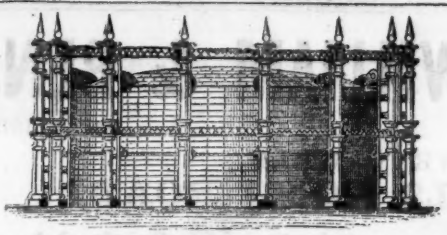
HOPKINS, GILKES, & CO.,
LIMITED,
MIDDLESBOROUGH,
SUPPLY GAS & WATER PIPES of EVERY SIZE.
Plain, Turned and Bored, and Coated.
CAST-IRON RETORTS.
Castings for Gas-Works of every description.
EXHAUSTERS.
LONDON OFFICE: 25, LAURENCE POUNTNEY LANE.

The BEST FIRE-BRICKS
Exported from the Tyne are branded ROBSON.
Apply to W. C. GIBSON, 43, Side, NEWCASTLE-ON-TYNE.

The CHEAPEST FIRE-BRICKS
Exported from the Tyne are branded ROBSON.
Apply to W. C. GIBSON, 43, Side, NEWCASTLE-ON-TYNE.

THOMAS CARR & SON,
MANUFACTURERS OF
FIRE-BRICKS, LUMPS, TILES, RETORTS, &c., &c.,
SCOTSWOOD FIRE-BRICK WORKS,
NEAR
BLAYDON-ON-TYNE.

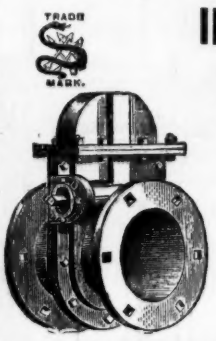
HOPE IRON WORKS, STOCKTON ON TEES.



ASHMORE & WHILE,
GAS ENGINEERS & CONTRACTORS,
MANUFACTURERS OF GASHOLDERS,
GAS APPARATUS OF EVERY DESCRIPTION,
Including Improved
Retort-Lids, Boilers, Cast and Wrought Iron Tanks, Iron Roofing, Bridges, Girders,
And GENERAL IRONWORK.

N.B.—Estimates for all Gas Plant and Remodelling supplied on application.

B. DONKIN & CO.'S
IMPROVED GAS-VALVES

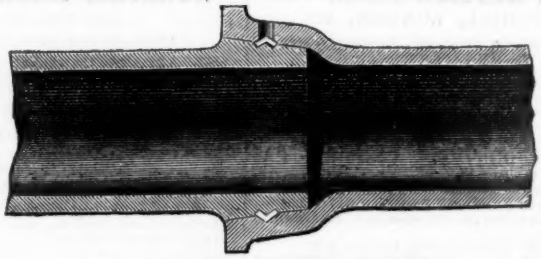


WITH WROUGHT-IRON PINIONS,
List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.
These Valves are all proved on both sides to 30 lbs. on the square inch before leaving the works, and are always kept in stock.
VALVES MADE WITH OUTSIDE RACKS TO ORDER.
ALSO,
SCREW WATER-VALVES WITH GUN-METAL FACES.

B. DONKIN & CO.,
GENERAL ENGINEERS AND IRONFOUNDERS,
MAKERS OF STEAM-ENGINES,
BLUE ANCHOR ROAD, BERMONDSEY,
LONDON, S.E.

ROBERT DEMPSTER,
GAS ENGINEER AND CONTRACTOR,

ROSE MOUNT IRON-WORKS,
ELLAND, near HALIFAX,
MANUFACTURES AND ERECTS
GAS APPARATUS & MACHINERY
OF EVERY DESCRIPTION.
GAS EXHAUSTERS,
WITH STEAM-ENGINES COMBINED.
DRY, CENTRE, AND BYE-PASS VALVES; WROUGHT-IRON AND CAST-IRON SCRUBBERS; ANNULAR AND PIPE CONDENSERS, ALL SIZES.
PURIFIERS from 4 to 40 FEET SQUARE,
Steam-Engines, and Steam-Pumps.
RETORT SETTERS & FITTERS SENT TO ALL PARTS.
ALL WORK AND MATERIALS GUARANTEED OF THE BEST DESCRIPTION.



SOMERVILLE'S
PATENT JOINTS FOR GAS & WATER PIPES

Require no "yarning," no "setting up," nor increased excavation for joint-holes, while less lead and less labour suffice for the making of joints, which have been proved to withstand 95 lbs. on the square inch, have stood the test of more than two years practical use, and must, from the principle of their construction, remain sound.
For Licences to Manufacture, apply to
Mr. W. H. BENNETT,
42 PARLIAMENT STREET, WESTMINSTER, S.W.

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

GEORGE ORME & CO.,

GAS-METER MANUFACTURERS, BRASSFOUNDERS & FINISHERS,

ATLAS METER-WORKS, OLDHAM.

CONSUMERS WET & DRY GAS-METERS ON THE MOST APPROVED PRINCIPLES.

STATION-METERS, GOVERNORS, PRESSURE-REGISTERS,

And every Description of Gas Apparatus.

GAS, STEAM, AND WATER FITTINGS.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

19, NORTHUMBERLAND STREET, STRAND, W.C.

MR. ANDERSON advises Companies on all matters connected with the manufacture of Gas and the construction of Works.

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS, heated by tar without the production of smoke.
STEAM-ENGINES and EXHAUSTERS, separately or combined.
FOUR-WAY VALVES, one of which is equal to three ordinary Valves.
STATION GOVERNORS—the Gasholder cannot tilt and cause accident.

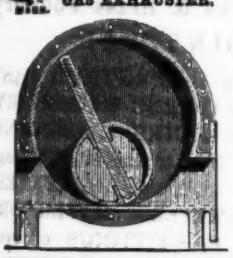
BREEZE AND TAR FUEL MACHINE.

A Pamphlet containing Eighteen Illustrations of the foregoing, with letterpress on the construction of Works, post free, 2s. 6d.

N.B.—The second edition of this Work, *now ready*, contains illustrations of the Machine for converting Breeze and Tar into Fuel for heating the Retorts.

"The Author is well qualified to speak authoritatively upon the important subjects to which his pamphlet refers."—*Artizan.*

TRADE MARK. J. BEALE'S PATENT GAS EXHAUSTER.



BEALE'S CONTINUOUSLY ACTING

GAS EXHAUSTERS

ARE NOW MANUFACTURED BY

B. DONKIN & CO.

MR. J. BEALE, of East Greenwich, having retired from business, has made an arrangement with B. DONKIN & CO. for the sole manufacture of his Patent Solid-Slide Gas Exhausters.

B. D. & Co. also make Steam-Engines to drive Gas Exhausters direct or otherwise.

Estimates and Prices on application to

B. DONKIN & CO.,

ENGINEERS & IRONFOUNDERS,

BERMONDSEY, LONDON, S.E.

TO GAS COMPANIES AND THE TRADE.

J. DEFRIES & SONS,

MANUFACTURERS OF

CRYSTAL, BRONZED, & ORMOLU CHANDELIERS, IMPROVED CRYSTAL STAR & SUN LIGHTS, AND THE PATENT CRYSTAL ILLUMINATION;

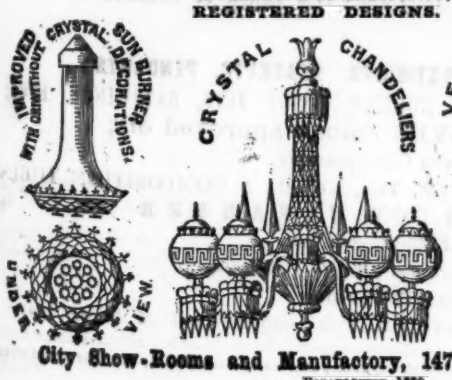
Vestibules, Iron Barrel, Composition Tubing, Dry & Wet Meters, & Gas-Fittings

OF EVERY DESCRIPTION.

WORKS: LONDON, BIRMINGHAM, & PARIS.

INTERNATIONAL EXHIBITION, 1872. CLASS 12.

REGISTERED DESIGNS.



Special Designs prepared in perfect accordance with architectural arrangements. Estimates furnished for the Lighting and Fitting up of Theatres, Music Halls, and Public or Private Buildings with Gas.

GAS MOONS of the newest designs.

The Patent Gas-Regulator and Purifier reduced to 6s. 6d. per Doz.

Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1873, are now complete.

City Show-Rooms and Manufactory, 147, HOUNDSDITCH, LONDON.

ESTABLISHED 1830.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,

CANNEL COAL MERCHANT,

HAYMARKET, EDINBURGH.

Established 1840.

LEE and JERDEIN,

COAL OWNERS & MERCHANTS.

Chief Office:

9, LANCASTER PLACE, STRAND, LONDON, W.C.

SOLE VENDORS FOR

LONDON & THE SOUTHERN COUNTIES

OF

WIGAN COAL AND CANNEL,

From the Mines of the

INCE HALL COAL & CANNEL COMPANY, Limited,

AND

Messrs. W. H. BRANCKER & Co.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

173, ST. VINCENT STREET, GLASGOW.

RUSSEL'S BOGHEAD.

MUIRKIRK, No. 1, CANNEL

Yields 11,600 cubic feet of 34·3-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

MUIRKIRK, No. 2, CANNEL

Yields 10,700 cubic feet of 32·77-candle gas per ton, and 9½ cwts. of coke, containing only 11 per cent. of ash.

RIGSIDE CANNEL

Yields 11,200 cubic feet of 35-candle gas per ton. Coke worthless.

Prices and full Analyses on application.

THE MIDLAND COAL COMPANY

Are prepared to enter into CONTRACTS with

CORPORATIONS & GAS COMPANIES

FOR SUPPLIES OF

GAS COAL & CANNEL.

Prices, Analysis, and other information on application at the

MIDLAND COAL OFFICES,

118a, OXFORD STREET, MANCHESTER.

POPE & PEARSON'S GAS COAL.—We have now the authority of several of the most eminent Gas Engineers of London in stating that our Coal yields *in practical working over 10,000 cubic feet of gas, with an illuminating power of 16 candles*; or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, West Riding and Silkstone Collieries, near Leeds.

OLD WEMYSS CANNEL COAL.—Yield of gas per ton, 12,896 cubic feet; illuminating power, 31·75 standard candles. Port of shipment, Wemyss.

Analysis and price on application to Mr. WM. CAREY, Manager, Wemyss Colliery, Kirkcaldy, FIFE.

THE

HUCKNALL COLLIERY COMPANY

Can offer a CANNEL COAL yielding a large quantity of Gas of superior quality.

Prices and information on application to the HUCKNALL COLLIERY COMPANY, Hucknall Torkard Collieries, near NOTTINGHAM.

CANNEL COAL.

COPPA COLLIERY, MOLD,

Beg leave to call the attention of Gas Companies to the superior quality of their

CANNEL FOR GAS-MAKING PURPOSES.

This Cannel produces in actual working, in iron retorts, 9000 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to The Coppa Colliery, Mold, FLINTSHIRE.

THE

UNVARYING WATER-LINE GAS-METER.

(SANDERS AND DONOVAN'S PATENT.)

"Unquestionably the best Water Gas-Meter now in use."

Over 90,000 in action.

MANUFACTURERS:

THE GAS-METER COMPANY,

KINGSLAND ROAD, LONDON;

WITH

Branch Manufactories at DUBLIN and OLDHAM.

ALEXANDER WRIGHT & CO.,

MANUFACTURERS OF

"WET" & "DRY" GAS-METERS

of the highest excellence.

STATION-METERS AND GOVERNORS.

STREET-LAMP REGULATORS.

TESTING APPARATUS

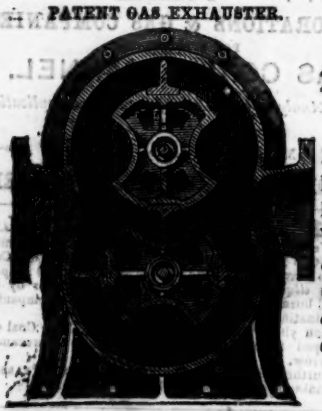
of the most perfect description for all purposes relating to Gas.

NOW READY.

"GAS MEASUREMENT AND GAS-METER TESTING," by F. W. HARTLEY, A. Inst. C.E. Third Edition, cloth boards, 2s.; per post, 2s. 2d.

55 and 55A, MILLBANK STREET, WESTMINSTER, S.W.

LAIDLAW'S PATENT GAS EXHAUSTER.



R. LAIDLAW & SON,

GAS ENGINEERS, CONTRACTORS, IRON & BRASS FOUNDERS,

Iron-Works and Foundries, GLASGOW,

Meter-Works & Brass Foundry, EDINBURGH,

Manufacturers of GASOMETERS & GAS APPARATUS of EVERY DESCRIPTION; CAST-IRON PIPES, all sizes, cast in DRY SAND and VERTICALLY by PATENT MACHINERY; IRON ROOFS, COLUMNS, BEAMS, & GIRDERS; BOILERS, TANKS, & CISTERNS; VALVES, Screw, Rack and Pinion, &c., for Gas and Water, with Iron or Gun-Metal Facings, &c.; WROUGHT-IRON TUBE and FITTINGS for Gas, Water, or Steam; GAS-METERS (Wet and Dry) of the most approved Construction, STATION-METERS, GOVERNORS, &c.; GASELIERS, BRACKETS, PENDANTS, PILLARS, & GAS-FITTINGS of every description; LAMP-POSTS and LANTERNS for Streets, &c.

London Address: 106, CANNON STREET, E.C.

D. HULETT and CO., 55 and 56, HIGH HOLBORN, LONDON,

PATENTEES and MANUFACTURERS of the ONLY GOOD MERCURIAL GAS REGULATOR,

Invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

MANUFACTURERS OF

GAS CHANDELIERS, GLASS LUSTRES, HALL LANTERNS, VESTIBULES, BRACKETS, PENDANTS;

DOUBLE CONE, ALBERT, SHADOWLESS, & EVERY DESCRIPTION OF BURNER, UNION JETS, BATSWINGS, ETC.;

IMPROVED FULL-WAY CARTER'S VALVES (much approved of);

GAS-STOVES, and every article connected with Gas Apparatus.

CAST & WROUGHT IRON PIPE, BLACK & GALVANIZED. COPPER, TIN, BRASS, & COMPOSITION TUBING.

D. HULETT'S IMPROVED SERVICE CLEANSER

for clearing out Mains, Services, and Interior Fittings—65s. net.

Boyle's Patent Silvered Glass Combination Reflectors and Outside Lanterns.

Sole Manufacturers of Church and Mann's Photometer.

Large Pattern-Books, with every description of Gas-Fittings, Chandeliers, &c., with complete Book of Prices, 12s.

London: Printed by WILLIAM BOUGHTON KING (at the office of Clayton and Co., 17, Bouverie Street, Fleet Street); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, June 3, 1873.